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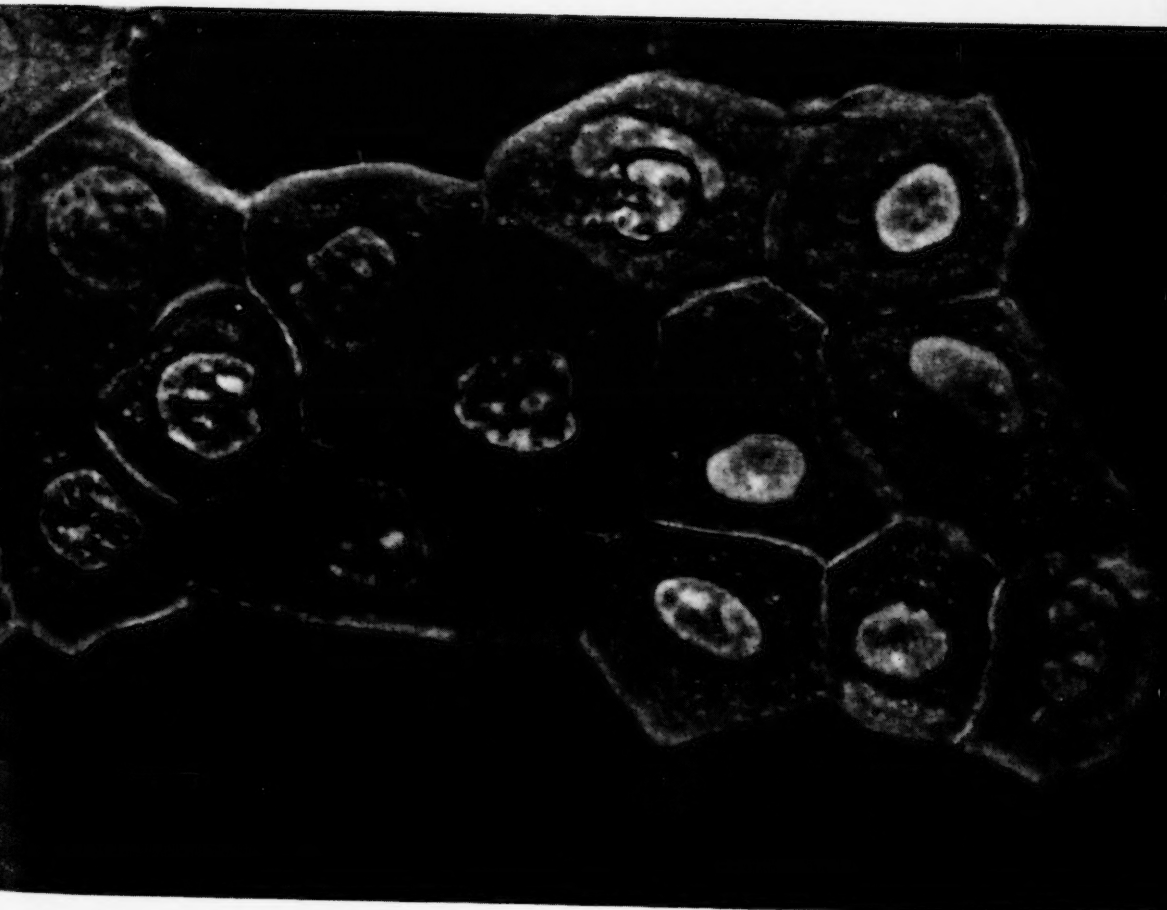

se Photomicrograph — Living Epithelium, 750x.

Oscar W. Richards

February 1951

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Editorial—The Journal

To Mr. Louis Paul Flory I send my congratulations and very best wishes for success in his new position with Mr. Eddy. In thanking him for his fine editing of our Journal, I am sure I speak for all our membership.

Unfortunately, his new position precludes his continuing as our Editor. Part of this issue was prepared by him. Rather than delaying publication until a new editor can be found and appointed, it seemed better to your Officers that I pinch-hit and publish this issue, even though it means using some manuscripts out of order for expediency, and may possibly not reach our high standards for format. We are all sorry for the delay which circumstances have forced upon us.

For the present please send manuscripts and all correspondence concerning the Journal to me at 70 Alton Road, Stamford, Connecticut.

OSCAR W. RICHARDS

21st Annual Meeting—Boston, Mass.

Hotel Kenmore, September 12-14, 1951

Now is the time to make plans for the meeting! Reports from Harding at Boston and Eddy at Washington indicate great activity underway and that they are planning to exceed the excellent meeting arranged last year by Creer and the Chicago Chapter.

Abstracts for papers to be presented must reach Mr. C. Graham Eddy, National Program Chairman, Medical Illustration Division, Veterans Administration, Washington 25, D.C., not later than July 30th.

Prize will again be given for the best paper presented at the meeting. May the judges have a more difficult time than last year! Papers will be rated for originality, technique, method, how well related to previous work, completeness, quality of illustrations, extent to which subject was explained or proved, and presentation which includes, voice, poise, interesting manner and the effectiveness of the presentation.—O.W.R.

Legibility of Lantern Slides

DAVID DANZIGER*

THERE have been many previous discussions in the Journal on the legibility of lantern slides, and various rules have been proposed to insure that everyone in the audience will see all there is to be seen when a slide is projected. This article is an attempt to explain a simple method for determining in advance how legible a slide will be when projected. "Legibility" refers not only to letters or numbers but to the distinctness with which small details in charts, photographs, or drawings can be seen. Rules involving measurement can become quite complicated. The writer has seen one paper which reports, for example, that in auditoriums having a room-image factor of 5, for a chart having a long dimension of 24 inches, lettering should be at least 0.1738 inch in height. Even though there are other considerations in the legibility of letters besides their height, it is doubtful whether there are many photographers, or even draftsmen, who are equipped to measure letter sizes to such a fine degree of accuracy.

The expedient proposed here does not require measurement of room size, screen size, image size, or even measurement of the copy. The only information required is the focal length of the projector lens.

Let us first consider a finished slide. When the slide is in the projector it subtends exactly the same angle, measured at the center of the lens, as the projected image does, no matter at what distance the screen lies. This is shown in A in the illustration. The screen image will be larger the farther it is from the projector, but the angle subtended at the lens, or for that matter the angular size of the projected image as seen by the projectionist, remains practically constant (there is a slight difference because, as the image distance increases, the lens must be moved closer to the slide to keep the image in focus). Normally, then, the slide lies at a distance from the lens equal to the focal length of the lens. To determine how legible a slide will be when projected, when the projector is not at hand, it is only necessary to hold the slide at a distance from the eye equal to the focal length of the projector lens. The slide is then seen under the same visual angle, and hence with the same legibility, as the projectionist will see it. If the slide is legible to the holder, assuming he has average vision, it should be legible to the least favored spectator who will see an even larger image provided the projector is situated behind the last row of spectators.

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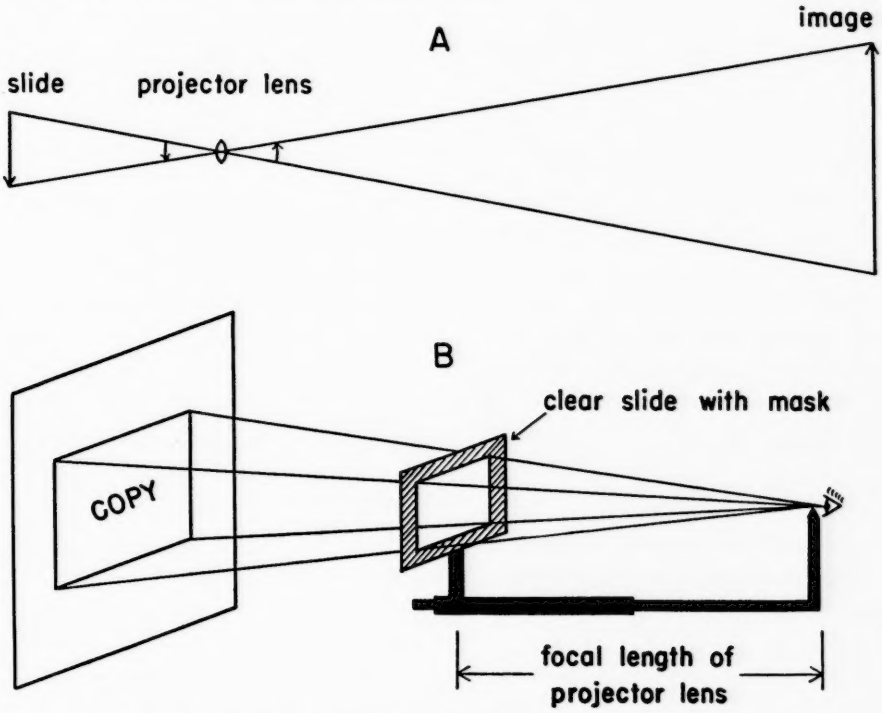
How can this principle be applied when judging material which must be reproduced on a slide? In the illustration, B shows a simple device in which the principle is applied in its most explicit form.



A. Geometry of lantern slide projection showing equal angles on each side of projector lens. B. Device for judging legibility of copy.

Lantern slide masks of the different sizes in use are each bound between two lantern slide cover glasses. (For standard dimensions of masks reference should be made to the American Standards Association Z38.7.19-1950 published on page 177 of Volume 18, No. 4 of this Journal. Ed.)

Each "dummy" slide may be placed in the clamp at one end of a bar whose length equals that of the focal length of the projector lens which would be used to project that size slide. When the other end of the bar is held in front of the eye, the slide will be at the correct distance from the eye. The eye looks through the clear area of the slide while approaching the copy until the material to be reproduced just fills the clear area. At that moment the eye sees the material at the same visual angle as the projected image will appear to the projectionist. If the material is legible then, it will be legible when projected. If not legible, the slide should not be made. Sometimes the copy, if divisible, can be

reproduced on two or more slides, permitting a larger image, and the device, by approaching to the point of legibility, will indicate where the division should be made. Where the copy has a different shape from the mask, it is obvious that it cannot fill both dimensions of the mask at once.

If the bar is made of tubing it can be made to telescope by using two pieces of tubing one of which slides within the other. In this way one bar can be made for lenses of from 3½ inches to 7 inches focal length (for 2-inch by 2-inch projectors) and another bar for lens of from 10 inches to 20 inches focal length (for 3¼-inch by 4-inch projectors).

As was mentioned above, this is the most explicit arrangement, but the device will be unduly large and cumbersome where the projector lens has a long focal length. The viewer can be reduced to any convenient size by making the same reduction (linear) in the mask space and the bar length. A 2¾-inch by 3-inch mask with a 12-inch bar would be equivalent to a 1⅜-inch by 1½-inch mask with a 6-inch bar, etc.

Mention should be made of the case where the projector is not situated behind the audience. If the projector is placed halfway between the screen and the last row of spectators, the farthest spectator will see the screen under one-half the visual angle that it will subtend at the projector. In such a case the device is made with a clear space of one-half the dimensions of the largest mask (or twice the normal bar length). Similar allowances are made where the projector occupies some other position in the room.

The viewer can be most useful in demonstrating to a person who orders a slide made just how it will project. If it discourages the making of slides which would later turn out to be unsatisfactory, with the consequent expense and disappointment, the slight effort required to assemble it will be amply repaid. It can also be used to inspect finished slides for legibility by substituting the completed slide for the dummy slide. In making drawings or doing lettering which is to be reproduced on a slide, it is a simple matter to view the drawing at intervals with the device as the work progresses to determine whether the details or letters have been made large enough for comfortable seeing.

Tridimensional Cytohistology

OSCAR W. RICHARDS*

MOST observations of cells and tissues with the microscope have been concerned mainly with two dimensions due to the limited depth of field of the microscope and the difficulties of comprehending the structural arrangement in the third dimension. Some question has also arisen as to the extent killing and fixing methods may have altered the specimen. Living material can now be examined with the interference and the phase microscopes and this paper will discuss some of the possibilities that the newer methods offer toward further knowledge of the structure of living organisms.

I. Mehanical or Optical Sectioning

Earlier methods used in the analysis of the third dimension were largely mechanical and not adapted to use with living specimens. The preparation, after sectioning, was enlarged and reconstructed by superimposing wax plates cut to the outline of the section, or by arranging photomicrographs or drawings on transparent mounts. The methods are given in manuals on micrology and have been summarized by Lison [16] (1937). Hegre[12] (1949) has accomplished a dynamic synthesis by photographing the top of the block, after each section was cut, on motion picture film, which, on projection, shows the details from one end of the specimen to the other.

Optical sectioning with the microscope is limited by the transparency of the specimen and by the working distance and depth of field of the objective. For this approach objectives of higher numerical aperture and minimum depth of field are preferable. The various layers may be observed as the microscope is slowly focused through the specimen, or a permanent record may be made by cinephotomicrography. As the depth of field is less, and the resolving power greater, with shorter wave-length radiation, the ultraviolet microscope is well adapted to this application (Lucas[17] (1934)). Phase microscopy is useful and may be used with many living specimens. An example of the advantage of optical sectioning with the phase microscope is the study of the distribution of mitochondria in blood cells by Jones[13] (1947).

II. Surface Examination

The shape as well as the structure of surfaces is important in the understanding of the third dimension and the functioning of the cellular components of

*American Optical Company, Research Laboratory, Stamford, Conn.
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living organisms. Three methods can be used as well as the classical method of direct observation.

When a surface has sufficient reflectivity it can be studied by interference microscopy. Greenham[10] (1946) has examined the surfaces of apple and eucalyptus leaves in this manner. A flat reference plate is placed immediately above the specimen and illuminated by a vertical illuminator using monochromatic light. The differences in thickness of the air path between the reference flat and the surface of the leaf give rise to interference figures that appear similar to the contour lines on a topographic map and indicate the third dimension of the surface in a corresponding manner (*cf.* Section III). The surfaces of some specimens do not reflect enough light and can only be examined in this manner after some reflecting material is placed on them. Various precipitating, plating, or evaporating technics can be used with specimens not damaged by such processes. Surfaces of thin sections of mica which had been plated with silver were measured by Tolansky[26] (1946) using an interference microscope.

Inframicroscopy according to Baud[4] (1949) is a combined use of polarizing, fluorescence, and other methods for observing small changes in anisotropy, birefringence, dityndallism, dichroism, and refraction at surfaces. He has illustrated this technic by a study of the fine ridges seen on the surface of squamous epithelial cells, which will be discussed later in Section IV.

Another method widely applicable to surface study is the preparation of a replica of the surface and the examination of the replica. The technics have been developed primarily for use with the electron microscope, but replicas can be examined with the light microscope. The phase microscope reveals details in replicas to the limit of resolution of the light microscope, because it changes the retardation due to the different optical paths formed by differences in thickness of the replica into visible absorption differences. It can be used on direct replicas or on replicas which have been shadow cast with a dielectric, or lightly with a metal, to increase contrast. Replicas of the surfaces of living cells have been made by Wolf[29] (1948). Replicas may be made by flooding the surface with a solution of celloidin or formvar which is carefully stripped off after the solvent has evaporated. Biological application of this technic with the phase microscope is discussed by Bennett *et al.*[5] (1951). Interference microscopy can also be used to study replicas.

III. Interference Microscopy

Regions of different optical paths (refractive index x thickness) in transparent specimens may be seen if the specimen is mounted between two flat metalized slides and examined when illuminated with parallel monochromatic light. Tolansky [25,26] (1946, 1948) has described the method in some detail.

Merton[18] (1947) discovered that it was not necessary to use optical flats as ordinary slides and cover glasses, and even cellophane, could be platinized and used for mounting the specimens. He focused the green-mercury monochromatic light on the ground undersurface of the slide and the specimen detail was seen against the broad interference fringes. Merton attributed the first use of the interference microscope to Frederikse[9] in 1933 and discussed the limitation of the method to transparent specimens of only a few micra thick. By suitable adjustment and by the use of green- or violet-mercury monochromatic light, the specimen can be made to appear in one color and the back-ground in another (Merton[19], (1947)). With thicker specimens zone plates were used under the microscope stage to direct the light and intensify the image.

The essentials for interference microscopy are a metalized slide and a cover glass between which the specimen is mounted, and a means for illuminating the ordinary laboratory or medical microscope with parallel monochromatic light.

The slide may be made reflective by evaporating (*in vacuo*) inconel or other metal onto the surface, by sputtering, or by platinizing from a solution of a platinum salt. Merton's[18] (1947) method consists of dissolving 2 grams of chloroplatinic acid in 77 ml of alcohol and 2 grams of celloidin in 33 ml of acetone and mixing the solutions. The slide or cover glass is coated by evenly flowing the solution on the surface. After drying, the glass is slid along a strip of stainless steel heated by a Bunsen burner at one end to about 500° to 600° C until all of the celloidin is burned off. After cooling, the surface is coated with a similar solution containing 0.2 per cent bismuth chloride and a few drops of hydrochloric acid which is likewise burned off and the surface flamed with the Bunsen burner to remove any remaining bloom. Hardy & Perrin[11] (1932) give directions for platinizing glass. Transmissions of about 50 per cent are useful for the broad-fringe method or about 10 per cent for the narrow-fringe method. Silver which is used in ordinary interferometry is toxic to living organisms and inconel, aluminum, or platinum is preferable. The above platinizing solutions do not keep and should be made only as needed.

The specimen is mounted between the metalized surfaces with a minimum thickness of fluid medium. Shim stock spacers (7μ up) or thin-drawn glass fibers can be used to support the cover glass or it can be floated on the liquid mount. A compressor (Wichterman[27] (1940)), with metalized cover glasses would be useful, although for extensive work some means should also be available for slightly tilting the upper member. This is useful in determining whether the contour line system is due to a rise or a hollow in the specimen.

A microscope illuminator with a 100-watt, T-8, CC-13 lamp and a suitable lens system may be used with an interference filter to give monochromatic light.

Such a filter should transmit at 555mμ to take advantage of the greater sensitivity of the eye to the yellow-green. The microscope condenser is removed and the illuminant adjusted to give parallel light. Greater intensity may be obtained with a mercury arc and filters which transmit only the green line (Wratten No. 62, or its equivalent. The AH-4 mercury arc can be used in a Spencer No. 370 microscope illuminator with a special admedium socket and a reactance transformer).

For examination with broad fringes a ground glass may be placed under the slide, or the lower surface of the slide may be ground. Differences in optical path show in color or intensity (Fig. 1A). Without the ground glass and with thicker metal films transmitting less light, the optical-path differences show as multiple fringes which appear like contour lines on a topographic map (Fig. 1, B & D), (Richards[22,23] (1949)).

Alteration in thickness or in refractive index will affect the path length, so unless the system is reasonably homogeneous the thickness differences cannot be measured. Of course, no living cell is strictly homogeneous, but some cells like the squamous epithelial cells from the mouth have less inclusions than other cells and with them the contour lines can be used to build a three-dimensional model (Fig. IC). Since mercury-green light was used, each contour shows a difference in thickness of a half wave length of mercury light or 0.27μ. In the model, thickness is emphasized by making the vertical scale 2½ to 1.

Marked regions of different optical density, such as ectoplasm and endoplasm would preclude this method. However, small regions such as mitochondria do not appear to influence the fringe pattern with magnifications of 50 to 400. Only proper use and critical study will reveal the possibilities of the method in cytohistology. On the other hand, the method can also be used for the study of gradients due to concentration changes (Ambrose[2] (1948), Thompson[24] (1948)).

For greater intensity a collimator similar to that of Ambrose may be used. His interference microscope was made as a modified Fabry-Perot Interferometer. A 4-cm focal length lens images the light from a low-pressure mercury arc on an aperture plate placed in the front focal plane of a 16-mm microscope objective. The latter thus becomes a collimater which illuminates the specimen with parallel light. The specimen is mounted between two metalized plates separated by 0.02- to 0.05-mm brass shim stock. Clamps hold the sandwich together. On examination with the microscope, fringes were seen corresponding to optical-path differences in the specimen. Dyson[8] (1949) has described a transmission type of interference microscope.

The condenser on the microscope can be used provided the microscope condenser and the lamp condenser are focused so that the fringes show with optimum

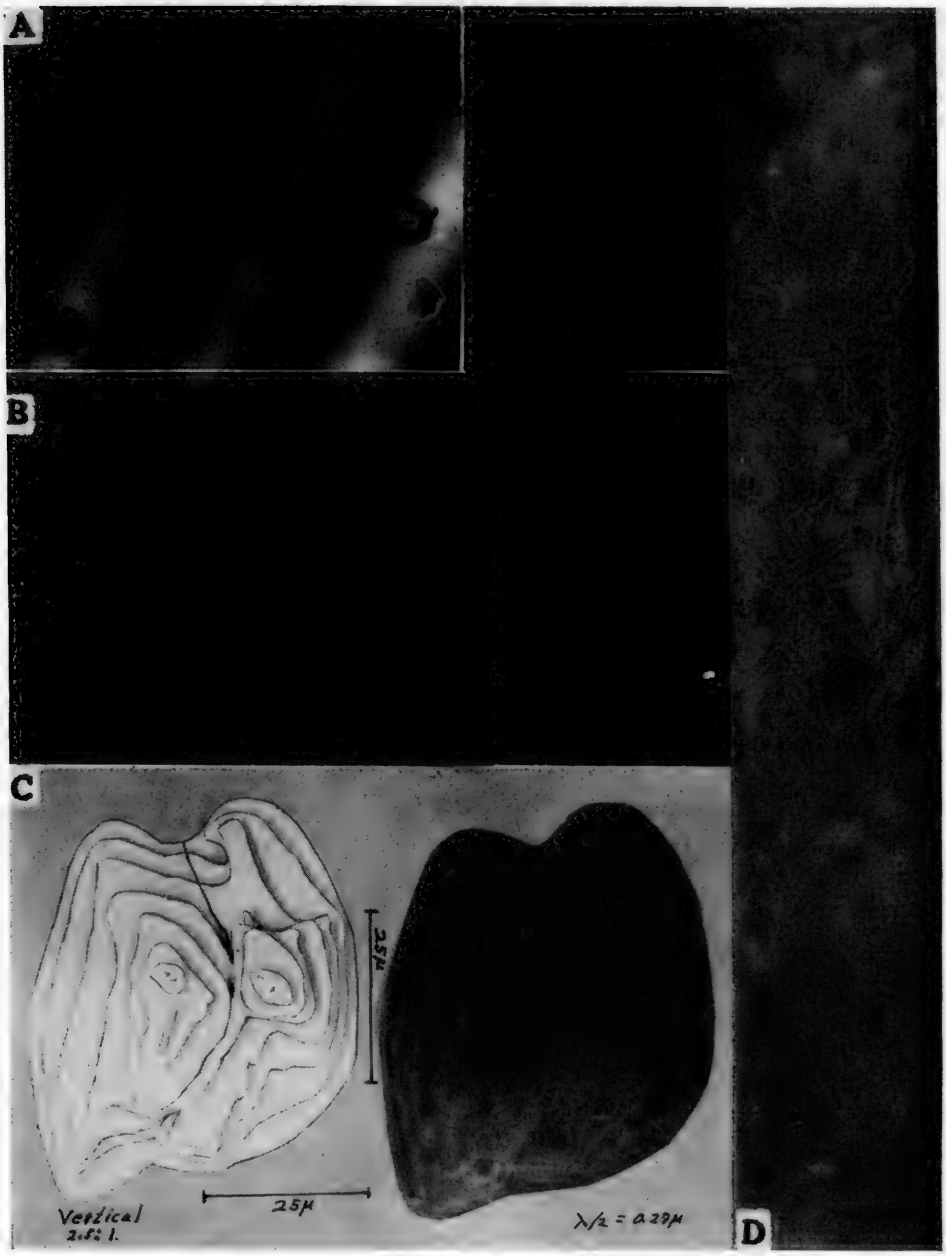

Figure 1. Human squamous epithelial cells from the cheek. Interference microscopy. A. As seen with broad fringes; 115x, 230x. A. As seen with narrow fringes; 200x. C. Two cells enlarged from B, and tridimensional model constructed from the contour lines. D. Contour pattern of fringes from a group of cells; 460x.

sharpness. Details of the nature and use of interferometers may be found in books on this subject (Williams[28] (1930)) or on physical optics.

IV. Stereophotomicrography

Within the depth of field of the microscope objective it is possible to make stereophotomicrographs and to see the distribution of the details of the specimen in three dimensions when examined with the stereoscope. By use of phase microscopy this technic may be applied to living cells and tissues (Richards[21] (1947)).

Several methods are possible for taking the two negatives for the stereoscopic pair (Cuzner[7] (1928)). With the 16-mm and lower-power objectives it is possible to tilt the specimen about 7 degrees to the right, take the picture, and then tilt it 7 degrees to the left and take the second picture. At greater magnifications the half-aperture method is useful. A piece of opaque, black cellulose tape is placed over the annular diaphragm of the phase condenser to stop all light from one lateral half of the opening. A picture is made, the annulus rotated 180 degrees, and the second picture made. This method does have the limitation of reducing the resolving power of the objective one-half, but this is usually not a practical limitation as few photomicrographs are made of specimens close to the limit of resolution. The orientation of the half-aperture stop on the condenser annulus can be observed with the centering telescope of the phase equipment. Care should be taken to obtain the best contrast by superimposing the image of the half annulus onto the diffraction plate in the objective. When the annulus is lowered by unscrewing a half turn, the light may have greater intensity and may require a correspondingly faster shutter speed to keep the density balanced for the stereoscopic pair. The simple phase condenser is more convenient than the turret for this application. Both negatives of each pair should be processed together. The two prints are mounted so that corresponding points are about 2¼ inches apart. It is essential that any lines or patterns in both pictures have the same orientation when the pictures are mounted (Kriebel[14] (1943)). The more transparent images from the bright (A+) and the dark (B—) are often preferable to the denser, dark (A—) for stereophotomicrographs.

The stereoscopic pairs may be observed with a stereoscope, although many people can fuse them into a single three-dimensional image without instrumental aid. To do this, hold the picture at the usual reading distance and lower it so that you can look over it at a distant object. Lowering the eye to the picture will then often help in securing fusion. Another method is to look through the picture as if they were at a distance. With practice one can learn to fuse the pictures without the aid of a stereoscope although at first it may be difficult.

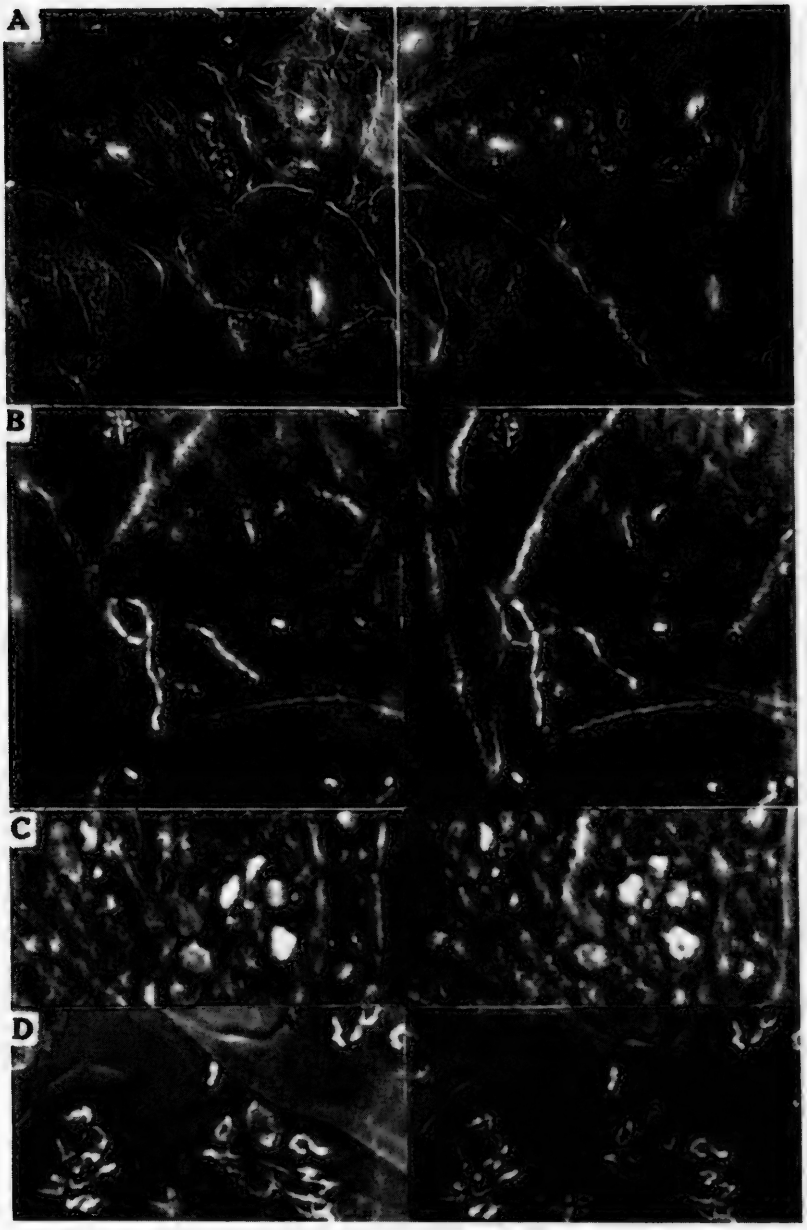

Figure 2. Stereophotomicrographs. Phase microscopy. A. Squamous epithelial cells; 560x. B. Same; 1040x. C. Vitreous body from unstained, fresh mouse eye; 1000x. D. Red-stained wheat chromosomes. Bright (A+) contrast, photographed with red light.

Ridges have been seen on the surface of squamous epithelial cells from the cheek. They were discovered independently by Albertini[1] (1946) and Ralph[20] (1947) using phase microscopy. Zollinger[30] (1948) concluded that the wrinkles were folds in the superficial layer of the cellular membrane interdigitating with those of the adjacent cells. Baud[4] (1949) concluded from his inframicroscopy that the ridges are a thickening in the cellular membrane " . . . in which the texture characteristics of the parting of the union are reintegrated in the general texture of that formation." He attributes the discovery of these ridges to Bizzozra in 1885. Chambers and de Rényi[6] (1925) concluded that the ridges were protoplasmic bridges between cells formed by pulling apart adjacent cells with a micromanipulator. Lewis *et al*[15] (1949), after observing their phase cinemicroscopy records, suggested that these surface irregularities might be fibrillar systems extending between cells.

The ridges are shown in Figure 2, A & B. With the oil immersion objective the pattern distribution may be seen (Fig. 2B). The level of cells in groups is observable and within the cell the distribution of mitochondria and other inclusions may be studied. The fibrillar structure in the vitreous body of the eye (Fig. 2C) and the arrangement of chromosomes in the cell (Fig. 2D) are readily seen in stereophasephotomicrographs. The vertical distribution of nerve fibers, muscle fibers, and small blood vessels may likewise be seen and followed. The ability to use three-dimensional microscopical methods with living material should facilitate understanding the structure of the living organisms.

Summary

In addition to the older methods of optical and mechanical sectioning and reconstruction, recent methods of interference and phase microscopy may be used to investigate the third dimension of tissue arrangement and cellular content. Both may be used with unstained living materials. Technics for studying surfaces are described. Reconstruction from the contour diagram obtained with the interference microscope can provide a tridimensional model of cells. Stereoscopic phase photomicrographs give permanent records of the distribution of cells in tissue or of inclusions in cells. Photomicrographs illustrate the technics described.

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Dr. Francis Carter Wood

Dr. Francis Carter Wood, internationally known cancer research specialist, died at the age of 81 at the Englewood Hospital, Englewood, New Jersey, January 5, 1951. Dr. Wood was Director of the Crocker Institute for Cancer Research at Columbia University for twenty-seven years, leaving that post in 1940 to retire. During his retirement Dr. Wood compiled an "Atlas on Tumor Pathology" which included 1500 photomicrographs prepared by him during his career. Dr. Wood received honors from medical societies throughout the world, and his strong photographic interests led him to directorships of Sound Masters, Inc. and Newsreel Theatres, Inc. He is survived by his son and four daughters.— LEV.

Color Duplication of Transparencies

JULIUS HALSMAN, S.P.E., B.P.A.*

THE duplication of color transparencies is an important part of the work conducted in the photographic division of the Medical Illustration Service, Armed Forces Institute of Pathology. Many of the original transparencies are deficient in color or detail and thus the process of duplication involves the solution of a number of problems in order to improve quality. But this alone is not enough, for it is also necessary to reduce or enlarge transparencies of all dimensions to the standard projectory sizes or to the proportions required for use in exhibits. Some of the factors which cause defects in the original transparencies together with methods for producing improved duplicates will be presented. Techniques which have proved to be successful at the Armed Forces Institute of Pathology will be given in sufficient detail to be used as a guide by those engaged in similar work.

Basic Considerations in Color Duplication

A thorough understanding of the characteristics of color photographic materials, of light quality, and of the equipment used is essential to success in duplication of transparencies.

The Photographic Material for Color Work:

The familiar three color process (monopack) is so designed that each individual layer of the emulsion is theoretically sensitive to one third of the visible spectrum. The results after exposure are the sum total of the energy distribution of the subject and the sensitivities of the dyes, plus the relationship between the exposure and the amount of dyes used. The three layers are exposed simultaneously, which means that the amount of exposure received by the individual layers is determined by the relative amounts of blue, green, and red in the exposing light. In other words, the source of light used to produce the exposure must be of the correct color balance or proportions if the proper relationship is to be maintained between the images produced in the three color layers. For example, if the exposing light is deficient in red (too blue green), the blue and green sensitive layers will receive too much exposure and the resulting transparency will be excessively blue green.

Effects of Change in Voltage:

A stable voltage is essential to consistent exposure results, because color balance is greatly affected by the voltage used to produce the light source. Changes in

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voltage have two major effects. The first and most important is a change in the total output of light, the second is a shift in the spectrum.

Using lamps rated at 115 volts, tests made on color film with the voltage raised to 125 gave results that were on the blue side; with the voltage lowered to 95, on the warm or red side. Slight shifts of voltage (5 or less) have little effect on the color scale, but result in a great change in light out-put. The shifting of voltage by as little as 10 volts ($\pm$) can be taken as approximately equivalent to a change plus or minus half a stop of the lens opening.

The shift of the spectrum caused by voltage changes has been recognized, and transformers have been manufactured to produce the proper Kelvin temperature from ordinary household lamps, by raising the voltage and overloading the bulb; these are available commercially.

Effects of Intensity of Light:

Intensity of the light reaching the film also has great effect on the recorded color, regardless of the color temperature of the light at its source. It will be found that there is a great difference in results with a weak light intensity, resulting in poorer color and a shift in the spectrum toward the red, than with a high light intensity, producing greater color saturation and a possible shift toward the blue.

Laws of Reciprocity:

Color balance is also affected by failures of the laws of reciprocity. According to the laws of reciprocity, photographic materials respond to the total amount of energy which falls upon the emulsion during the exposure. The final result of an exposure of 1 second at *f*.8 would be the same as an exposure of 2 seconds at *f*.8 with a light source of half the intensity used for the first exposure. Of equal importance is Van Kreveld's law, which states that if two different wave lengths of light at a given time of exposure have their intensities so adjusted that each will give rise to the same density on development, they may be mixed in any proportion and will produce the same density.

These two combined constitute the law of reciprocity. Whereas the law holds fairly true for black and white photography, it fails in color work. The response of the emulsion to light of various wave lengths becomes the sum effects of all the wave lengths. Furthermore the wave length regions of a color, which in themselves would not be sufficient to produce a developable image, do affect the final results.

In the subtractive process the final positive image is composed of a dye whose principal absorption lies in the region which is transmitted by the taking filter, and whose transmission is mostly of the color absorbed by that filter. In a full color process the images would be minus blue (yellow), minus green (magenta), and minus red (cyan).

Color Temperature:

The quality of an illuminant is frequently specified in terms of its color temperature in degrees Kelvin (K). This is the temperature to which a "black body" or perfect radiator must be heated in order that its emitted radiation will have the same spectral energy distribution as that of the illuminant. The degree units are the same as those on the Centigrade scale, but the zero point is approximately -273° Centigrade.

The color temperature of an illuminant is not usually its true temperature, but merely the temperature of a black body that would radiate the same light quality. Only sources with a continuous spectrum have a true color temperature.

The shift in color quality due to temperature changes runs through all types of light, so that, theoretically, by measuring the color the temperature is known; or, conversely, by measuring the temperature the color is known. At 5400 degrees Kelvin the light is white, and at this point light consists of substantially equal amounts of the three primary colors, blue, green, and red. As we go up the scale in Kelvin degrees, the first important change observed is at 5900 degrees Kelvin. Here the primary blue in the light is in excess and overbalances both the red and green primaries. Going down the scale, at 4800 degrees Kelvin the red primary overbalances both the blue and the green primaries.

There is no practical way of determining the color temperature of an illuminant with the unaided eye, but on the market are color temperature meters that will enable the photographer to gauge the color quality of the light and, with appropriate filters, to correct or bring it to the proper color temperature.

Sensitometry:

Another factor which must be carefully determined is the sensitivity of the photographic material. Photographic sensitometry is the science of measuring the quality response of the material to light and to development. It consists of the quantitative measurement of the relation between the density of the photographic image and the treatment to which the material has ben subjected. All methods of sensitivity measurement require a standard light source, a means of giving fractional exposures, a standard development, and criteria for interpreting the response of the material to the process of exposure and development.

Densitometry:

The instrument used to measure the transmitted light of the image is called a densitometer. It is essentially a photometer with a light source capable of being adjusted to a standard intensity. If the results of the densitometric readings are to be of any practical help, the radiant energy of the light, the time and intensity of

the light, the time and intensity of the exposure, and the developing conditions must be the same in practice as they are in tests. The quantity of a photographic image produced by a combination of exposure and development can be measured by the amount of light stopped or transmitted by the image.

The light transmitting and light scattering effect of the emulsion of transparencies differs slightly for the various wave lengths of light. The differences in readings of specular density and diffuse density are so small that they may be ignored in our method of color duplication.

Quality of Original for Color Duplication:

A transparency must have one technical qualification if a good color duplicate is to be expected. It must show all important details both in the areas of high light and shadow. If the transparency was overexposed, high light areas appear "washed-out" (the high lights lack modelling and color saturation and fine detail is lost). If the transparency was underexposed or if contrast due to lighting was excessive, details will be obscured in the areas containing shadow detail.

Transparencies which project well may not print well. Projecting a good transparency will yield a brilliant full scale screen image, but the range of tones is often too great to be reproduced by any known method of color duplication. If a transparency is to be duplicated, it may be well to underexpose it slightly to insure high light detail in the final print.

Color Correction of Transparencies During Duplication:

Transparencies which are overly dense because of underexposure may be copied and made useful by giving enough exposure to overcome the density of the original. In the case of overexposure, if there is enough color in the original, reduction in exposure time will result in a more correct duplicate. If, however, there is not enough color saturation in the original to warrant this method, a light duplicate can be made, bound in register with the original, and then copied.

Another method to correct or intensify color locally is to apply dyes to the transparency or to a sheet of cleared film bound to the original. By this method local correction can be quickly and accurately done.

The inefficiencies of the absorption characteristics of the dyes which form the three images in integral tri-pack (monopack) color materials are well known. It is sufficient at this time to state that printing a color transparency without modification on material of the same type will intensify the color distortion present in the original. The blues will suffer most. The two most imperfect dyes used in a monopack film are the magenta and cyan and in a duplicate they will tend to go too dark.

Another difficulty encountered is that color transparencies are normally developed to a high contrast, a gamma approximately 1.6 to 1.8 being necessary for high color saturation and brilliance. To insure color saturation plus brilliance in duplicates they should be treated in exactly the same manner. This however, means further raising of the high contrast already attained in the processing of the original transparency. Since the duplicate contrast is the sum total of the gradational characteristics of the original plus the duplicating material, the result in many cases will be a duplicate of excessive contrast.

The difficulty cannot be overcome by developing the duplicate to a lower contrast because of the resulting loss in color brilliance. Instead, the contrast can be reduced by means of a mask. This mask is merely a "thin" negative made from the original transparency. The mask is placed in register and bound to the original; the duplicate is then exposed through the original transparency plus the mask. Besides the contrast softening effect of this mask there is another benefit to be derived. Since the blues will tend to be too dark in the duplicate, the solution is to restrain or hold back the blue. Therefore the logical means is to expose the contrast mask through a G filter which will result in a subtraction of the blue determined by the density of the mask.

While there are many faults to be found in making direct duplicates (without masks) on Kodachrome, Ansco color, or Ektachrome, nevertheless passable duplicates can be achieved fairly easily.

Process of Color Duplication

It must be understood that the following data are arbitrary and apply to the equipment and instruments in use at the Armed Forces Institute of Pathology. To achieve similar results is a matter of correlation between the data and the equipment available. Assuming that all processing will be performed by the manufacturers, and that the color material used will be Kodachrome or Ansco color film, all data will apply to these two types of color film only.

The basic equipment necessary to duplicate color transparencies and to correct "off color originals" is as follows: 1) A set of color correcting filters (See chart 1). 2) A good exposure meter that is accurate and the readings spread at the lower end of the scale, or a sensitive photoelectric meter. 3) A light source (adjustable in intensity) to be used as a standard to determine exposure times, or a densitometer. 4) An enlarger with an optical system as free as possible of paint or any colored material that may effect the quality of light. 5) A highly accurate shutter or a split second timer of the electronic type (based on 1/10 of a second intervals).

The light source used for density readings may be a wooden box containing a 6 volt bulb and transformer and rheostat. A hole 2 mm in diameter should be drilled in the top of the box directly over the bulb. A Weston meter with light gate opened is placed in contact with the box directly over the light source, and the rheostat is adjusted until the light reading is 25 plus on the meter scale. This becomes the standard light source used to determine the amount of light transmitted by a 2 mm area of a transparency.

KODAK COLOR COMPENSATING FILTERS

Peak Density	Yellow (Absorbs Blue)	Exposure Increase in Stops*	Magenta (Absorbs Green)	Exposure Increase in Stops*	Cyan (Absorbs Red)	Exposure Increase in Stops*
.05	CC-05Y	—	CC-05M	⅓	CC-05C	⅓
.10	CC-10Y	⅓	CC-10M	⅓	CC-10C	⅓
.20	CC-20Y	⅓	CC-20M	⅓	CC-20C	⅓
.30	CC-30Y	⅓	CC-30M	⅔	CC-30C	⅔
.40	CC-40Y	⅓	CC-40M	⅔	CC-40C	⅔
.50	CC-50Y	⅔	CC-50M	⅔	CC-50C	1
Peak Density	**Red (Absorbs Blue and Green)**	**Exposure Increase in Stops***	**Green (Absorbs Blue and Red)**	**Exposure Increase in Stops***	**Blue (Absorbs Red and Green)**	**Exposure Increase in Stops***
.05	CC-05R	⅓	CC-05G	⅓	CC-05B	⅓
.10	CC-10R	⅓	CC-10G	⅓	CC-10B	⅓
.20	CC-20R	⅓	CC-20G	⅓	CC-20B	⅔
.30	CC-30R	⅔	CC-30G	⅔	CC-30B	⅔
.40	CC-40R	⅔	CC-40G	⅔	CC-40B	1
.50	CC-50R	1	CC-50G	1	CC-50B	1⅓

***These values are approximate. For critical work, they should be checked by practical test, especially if more than one filter is used.**

Chart 1. The peak densities of various filters and their absorption characteristics. Taken from Filters and Lens Attachments, Rochester, N.Y., Eastman Kodak Co., 1950, p. 15.

Testing:

Examine the transparency to be duplicated and select an area that contains the lightest tint (not a white or a specular highlight); place this area over the 2 mm opening and place the meter in contact with the transparency. Gently move the meter till the highest light reading is obtained. This reading becomes the diffuse density reading (See Chart 1) and will be used to determine the exposure time.

Set the film speed on the exposure meter dial to 10 and direct the arrow on the calculator scale to the reading obtained through the transparency (the figure .7 on the *f* stop part of the calculator dial will be the "Take Off" point on expo-

sure reading); read the exposure that *f*.7 indicates. For example, if your reading through the transparency is 6.5, turn the calculator dial till the arrow points to this figure and then read the exposure indicated by the *f*.7; the exposure will be ⅔ second, or if the reading through the original was .8 the proper exposure will be 5 seconds (See Chart 2).

Transmission and density calabrations with exposure times for color materials that have an American Standards Speed of 10. These tables are based on a light value of Weston 40.00 for the densitometric readings, and a light value of Weston 1.00 for the exposure source (at the focal plane)

ANSCO SWEET DENSITOMETER		WESTON ANALYZER		WESTON MASTER	EXPOSURE FOR A.S.A. 10
				100	
				80	
				65	
				50	
.0	.10	.0	.10	40	
.10	.20	.10	.20	32	.1
.20	.30	.20	.30	25	
.30	.40	.30	.40	20	
.40	.50	.40	.50	16	.2
.50	.60	.50	.60	13	.3
.60	.70	.60	.70	10	.4
.70	.80	.70	.80	8	.5
.80	.90	.80	.90	6.5	.6
.90	1.00	.90	1.00	5	.8
1.00	1.10	1.00	1.10	4	1.00
1.10	1.20	1.10	1.20	3.2	1.2
1.20	1.30	1.20	1.30	2.5	1.5
1.30	1.40	1.30	1.40	2.	2.
1.40	1.50	1.40	1.50	1.6	2.5
1.50	1.60	1.50	1.60	.80	3.
1.60	1.70	1.60	1.70	.65	4.
1.70	1.80	1.70	1.80	.50	5.
1.80	1.90	1.80	1.90	.40	6.
1.90	2.00	1.90	2.00	.32	8.
2.00	2.10	2.00	2.10	.25	10.
2.10	2.20	2.10	2.20	.20	13.
2.20	2.30	2.20	2.30	.16	16.
2.30	2.40	2.30	2.40	.13	20.
2.40	2.50	2.40	2.50	.1	25.
2.50	2.60	2.50	2.60		32.
2.60	2.70	2.60	2.70		40.
2.70	2.80	2.70	2.80		50.
2.80	2.90	2.80	2.90		64.
2.90	3.00	2.90	3.00		80.

Chart 2. The comparative meter candle readings of an Ansco Sweet Densitometer, a Weston Photographic Analyzer, and a Weston Master Exposure Meter. In using this chart, follow the line of density readings across to the exposure column from which the proper shutter speed can be ascertained.

To set the light from the enlarger: 1) Place the transparency in the negative carrier and bring to size and focus. 2) Remove transparency and place the proper filters in the enlarger (in front of or behind the lens). 3) Place the meter

Figure 1. Method used to determine the proper light intensity of the enlarger with a multiplying printing frame.

(Weston) on the easel with the dial facing you, and with a mirror direct the light of the enlarger (through the filters) into the cell of the meter; adjust the diaphragm till the meter reads .8 plus. This is the standard light source to be used with the foregoing calibrations (Fig. 1).

To insure constant results, tests should be made on different emulsions since they vary in color balance. In using a film of one emulsion number, the only filter necessary may be of the yellow series, whereas another film bearing a different emulsion number may require a yellow plus a red.

While the present stock of Kodachrome in use at the Armed Forces Institute of Pathology requires a yellow and red filter to achieve the proper results, it is suggested that a series of tests be made, first to check the readings and the exposure, then to check the color balance. 1) Make an exposure from a good transparency without any filters. 2) Make an exposure from the same transparency with a

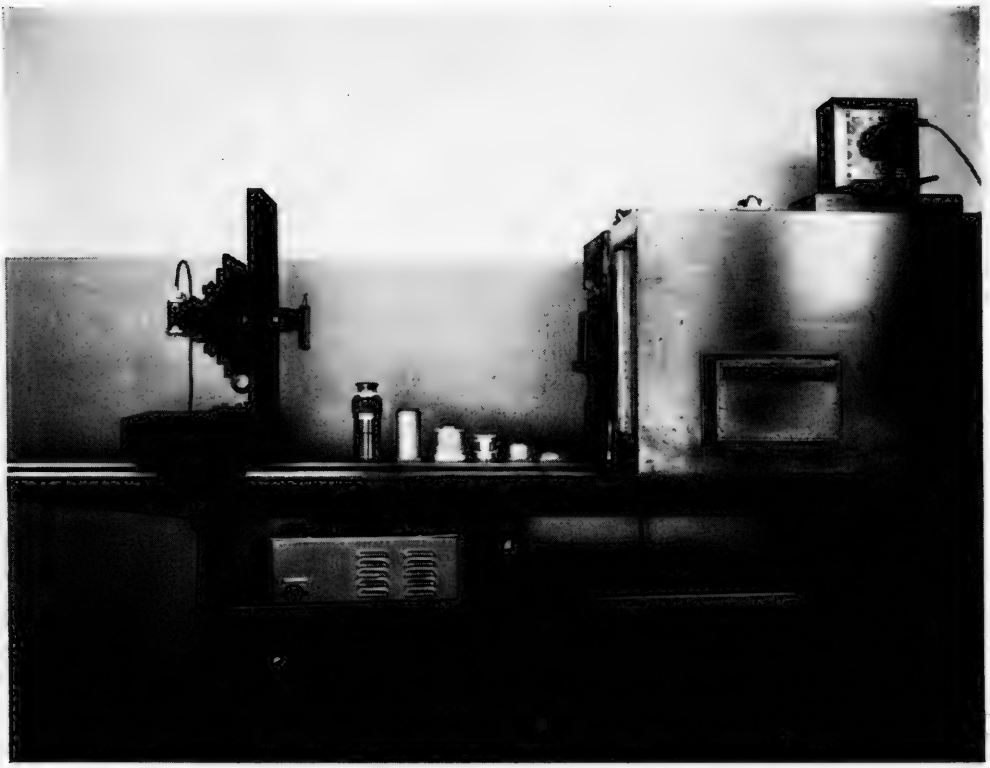

Figure 2. Equipment for copying transparencies of various sizes on 35 mm color film. The voltage regulator resting on the light box is used to insure that a constant voltage of 115 is received by the light source. The camera, a Leica, is mounted on a modified view camera bed and can be moved either toward or away from the copy, with rising, falling, and rotating movements on the camera mount.

10 yellow. 3) Make an exposure from the same transparency with a 10 magenta. 4) Make an exposure from the same transparency with a 10 yellow combined with a 10 magenta.

With these tests it will be possible to determine what filters will be necessary to bring the light into proper balance.

Duplication:

When all testing is completed and the basic filter set is established, color correction can be attempted by the use of additional filters (See Chart 2).

If the original transparency is of the correct density but "off" in color, it can be corrected somewhat to give a more pleasing duplicate. Should an original be too blue, the addition of a filter of the yellow series in conjunction with the

Figure 3. A rear view of the camera mount showing the Leica Focaslide mounted on the rotating back.

standard filter set will give a duplicate with as much of the blue coloring eliminated as determined by the strength of the yellow filter. If the original is too red, a filter of the cyan series will remove a proportionate amount of red.

The steps to be followed are: 1) Adjust light in densitometer to read 25 plus on meter (Weston). 2) Read selected area to get exposure. 3) Select corrective filters plus normal set. 4) Place transparency into negative carrier of enlarger,

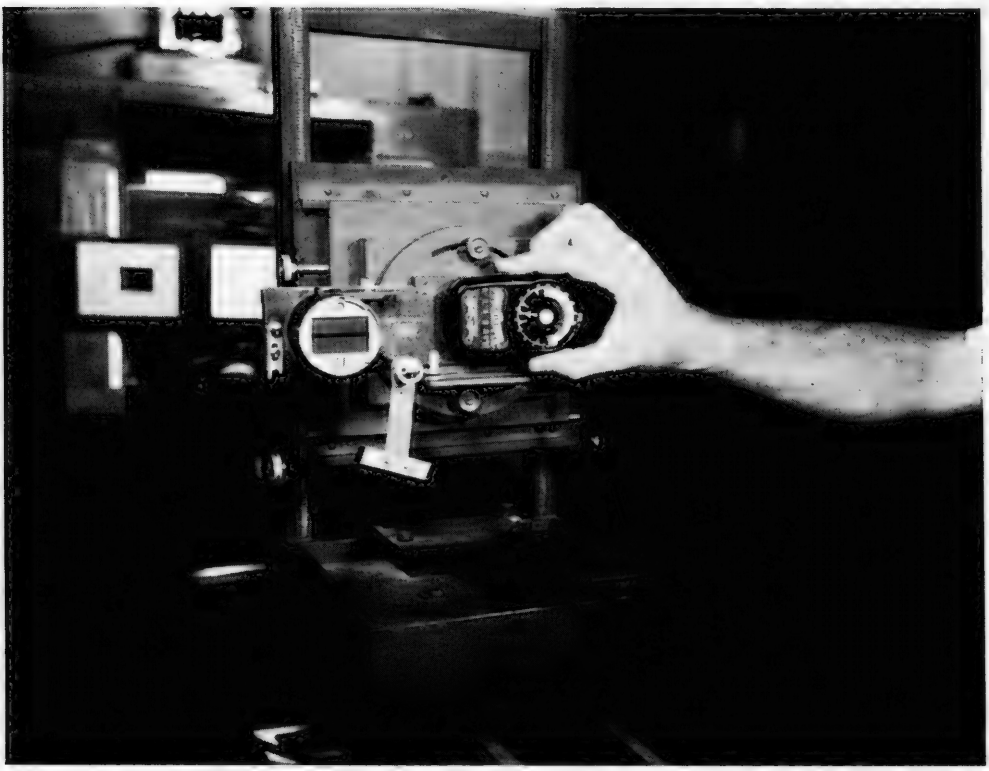

Figure 4. Method used to determine the proper light intensity for 35 mm stock.

bring to size, focus, lock enlarger. 5) Remove transparency and place filters in enlarger and adjust the intensity of light by means of the meter. 6) Place the transparency in negative carrier. 7) Adjust easel to position. 8) Set the timer or shutter.

If this technique is followed with care the resulting duplicates should be satisfactory.

Reduction and Enlargement:

With the advent of color in medical photography many doctors and institutions made photographs of gross clinical and surgical material with almost any camera on hand, 35 mm, 828, 2¼ x 2¼, 4 x 5, 5 x 7 and 8 x 10. Many institutions have only 35 mm projection equipment and requests are received from time to time for sets of 35 mm color slides from originals which are of almost every size known. The problem was how to do this large quantity of work efficiently. A Leica camera and extension tubes were chosen as the means of duplicating original films to 35 mm color stock; and, as the illustration shows, the equipment is very flexible (Figs. 2, 3). The light source is an R 2 reflector flood 3400° K installed in a light box lined with aluminum foil. The light is diffused by the use of opal glass. Tests must be made to bring this light into correct color balance, and necessary filters combined with the optical system of the camera.

The same method of timing exposures is used as in projection, i.e., the camera shutter is opened, and the exposure is controlled by light duration.

The methods used to obtain light readings at the focal plane are as follows: Focus and bring the subject to size; remove the transparency and the camera and hold the meter at the approximate focal plane; close the diaphragm to obtain the correct light reading, or read the light through the ground glass and compensate for the opacity of the glass (Fig. 4).

In using the tables of density and film speed it will merely be a matter of correlation between the equipment on hand and the data supplied to enable one to produce color duplicates.

Conclusion

The production of duplicates from inferior or even good color transparencies is far more complicated than photographing the original material. It demands a thorough knowledge of the theory of color, of intensity and color of the light source, of the effects of filters in combination with a variety of masking materials and processes, as well as a sound background in black and white photography and extensive experience in dark room processing.

Visual Teaching Aids in Medical Education

JOHN K. LATTIMER, M.D., Med. Sc. D., F.A.C.S.*

THE most valuable tool in the hands of the medical educator is the visual teaching aid. This is perfectly obvious to you as medical illustrators, but it is not fully understood by the majority of physicians. These same physicians form a large proportion of the instructors in our medical schools. Even the large medical schools do nothing to educate their instructors in teaching methods or in the use of teaching aids. A few doctors had their eyes opened by the excellent visual teaching methods to which they were exposed at the Carlysle and other Medical Field Service Schools during the war.

Educate the Doctor

Almost all of the troubles which you have with doctor clients stem from the doctors' ignorance of your art. You must be able to explain to them what things are possible, what are impossible, and how they can help you. Since you are making your living at medical illustrating it is up to you to acquaint the doctors with the possibilities of this medium.

When a practising physician becomes interested in some pet specialty, he is likely to collect a few more cases than the next fellow, and he is likely to want to publish them. He will call upon you for from two to six illustrations, since no more than six are usually permitted in the medical journals. These illustrations are rarely as well thought out as his text. He needs your help in preparing the illustrations. When his series of cases gets so large that a national association calls upon him for their annual address, he will come to you for lantern slides. He will rarely need more than four or five lantern slides, so these must be very carefully planned. If the doctor discovers some small technical point, he is likely to desire that a movie be made to illustrate this point. The movie will usually be short, it will usually have few titles and will have no fancy trimmings. These jobs are small scale projects but if you multiply them by 100 doctors they become a big business. If the doctor's presentation is successful, thanks to your illustrations, he may then procure research grants for large scale illustrations. You may be in a position to direct him to research money.

See the Doctor's Side of It

The doctor slaves right up to his deadline, working between patients and then will not realize why you cannot put together his little group of slides

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over Sunday for his speech on Monday morning. You must look at it from his standpoint; the viewpoint of the zealot. He does not realize that you have 20 such little jobs to do that week. He will ask you to give up your weekend. He will tend to cram too much material on each slide. His movie may be full of boring repetitions. Don't get angry at him! Educate him! Be pleasant about it.

Make Books of Samples

I would like to suggest that each of you make up a sample book with examples of good and bad techniques in illustrations and in lantern slides. You can show your client what to do, what things can be done and what things cannot be done. Demonstrate bad examples of over-crowding on slides and illustrations. *Be sure that he makes his illustrations the same proportion as the page of the journal in which he is going to publish his article.* Ask your doctors to arrange pathological specimens on the photographic table in the correct anatomical position so they conform to the accompanying x-rays. Have redundant tissue trimmed away. Keep labels off the specimen. Use arrows or pointers. Have examples of photographs arranged serially to illustrate progression of diseases. Mount some x-rays and specimens side by side. Compare color with black and white. Urge that a Kodachrome lantern slide and also a black and white film be taken, so that the best result can be obtained both for presentation and publication. If possible, prepare a sample movie filled with common errors; show the head and hands of a surgeon of the field, demonstrate poor visualization in the incision, show bloody draperies, show long and boring repetitions with endless suturing. You can then demonstrate how the surgeon can improve his movies by loosening the tumor before removal so that it can be lifted out cleanly and quickly. You can show him how much better the draperies look when they are clean, and how the table can be tilted into Trendelenburg position so the camera can point into the bottom of the incision. Demonstrate how to omit suturing and dissection of difficult tissue planes. You can help the surgeon edit the movie in general.

You must show him these errors diplomatically because many of these surgeons are very dominating people. They have been taught to rule the operating room and may spoil your picture before you can raise your voice in objection. Show how to use flashbacks in the movie, before and after. Show how to shorten a movie.

Attitude Before Patient

Be careful of your attitude before the patient. Sick persons are no longer the rational people that they were when they were well. Do not permit levity in the photographic studio. Don't joke back to the patient even though he will often

try to be humorous in his embarrassment. Don't laugh loudly in the dark room or in adjacent rooms. Patients who are in the nude resent this bitterly. Don't violate the modesty of any of your patients. Be sure that all the doors are closed, that everything is quiet and that the exposure is as brief as possible. If you are questioned by the patient, emphasize the point that these photographs are not for display but are only for scientific information. Remember that the patient will always try to get information from you about his condition. He will want to know if you ever saw anything like it, if you think his condition is serious, if it is cancerous. People have even gone to the extent of instituting a lawsuit because of information which photographers or other hospital personnel have given to them as offhand statements. Try to maintain a serious, dignified and quiet atmosphere in your photographic studio, but be pleasantly non-committal.

Be Businesslike

Run your illustration business on a business basis. Make a layout for every illustration. Make it and go over it with the doctor for detailed written instructions. Try to do the job at once while the layout and instructions are fresh in your mind. Deliver your work on time. This is one of the common faults of medical illustration laboratories. Try to standardize your prices. Explain why they are so expensive in that they are handwork. It would be desirable if a booth could be set up at medical conventions to accommodate the last minute speaker who has broken or lost one of his slides. Make it very clear to the doctor how poor the pictures will be if he does not help you out.

Prepare your convention equipment ahead of time. Try the projectors, and run through your slides. Carry a small repair kit to the meeting or see that the doctor does. Try out the complete equipment in the operating room. See if you have space enough. See if you have explosion-proof switches. Be sure that you have an assistant who can hand you film, etc. Operations give you only one chance. If you are too late or if some of your equipment doesn't work, the entire procedure is lost. Use two loaded cameras in the operating room. If one goes wrong all will not be lost. You can reload without losing time. Don't let the patient see the camera in the operating room. Bring it in after he is under the anesthesia. On the other hand, do get set up in time to catch the initial skin incision.

Receptionist

The receptionist in your office is a very important link. She may unconsciously take the attitude that your studio is overworked and cannot be bothered with additional jobs. A pleasant and sympathetic office girl will help your business.

Remember that most of your difficulties can be corrected if you are sure to explain, with illustrations of right and wrong, to the doctors and to the medical educators, how they can help you and how you can help them. It is my belief that the future of good medical education lies with you people and your art.

Standing Committees

Committee	*Chairman*	*Address*
Award	Stella Zimmer	State University of New York Medical Center 766 Irving Avenue Syracuse 10, New York
Exhibitions	William J. Taylor	Temple University Hospital Broad St. at Ontario Philadelphia 40, Pa.
Fellowship	Ferdinand Harding	The Children's Medical Center 300 Longwood Avenue Boston 15, Mass.
Local Chapters	Warren Sturgis	Sturgis-Grant Productions 314 East 46th Street New York, N.Y.
Membership	Anne Shiras	Photographic Department Magee Hospital Pittsburgh 13, Pa.
Motion Picture	C. Graham Eddy	Medical Illustration Division Veterans Administration Washington, D.C.
Publicity	Lloyd E. Varden	Pavelle Color Incorporated 533 West 57th Street New York, N.Y.
Salon	H. Lou Gibson	Eastman Kodak Company 343 State Street Rochester 4, N.Y.
Sustaining Members	Dr. Edmond Farris	The Wistar Institute Philadelphia, Pa.
Traveling Salon	Thomas J. Lannon	Cleveland Clinic Foundation Euclid Ave. & E. 93rd St. Cleveland 6, Ohio

17th Report of the Committee on Motion Pictures

I. Members Reporting and Films Produced

Burd, Charles R.

"Hemangioma of the Orbit." C, Si.
"Ureter Sigmoid Transplant with Elliptical Anastomosis." C, Si.
"Cataract Surgery with 6-0 Catgut Suture." C, Si.
"The Human Cervix in Health and Disease." C, Si.

Films available from Photography Department, University Hospital, Ann Arbor, Michigan.

Claff, Lloyd

"Thousand Feet Operations of Otter Trawling." C, Si.
"Gas Analysis in Swim Bladder of Fishes." C, Si.

Christopher, Ronald M.

"Total Gastrectomy." C, Si.
"Supra-Omohyoid Neck Dissection." C, Si, 800 ft.
"Laryngo Fissure." C, Si, 650 ft.

Films not available.

Dunton, Samuel C.

"Happy Birthday"—Fiftieth Anniversary of the New York Zoological Park. C, Si, 700 ft.
"Animal Hospital"—Equipment and methods survey of the Zoo Hospital. C, Si, 300 ft.
"Looking for the Answers"—Experimental studies of animal behavior at the Bronx Zoo. C, Si, 400 ft.

Films available for rental or purchase from Education Department, New York Zoological Park, New York, New York.

Irwin, Bruce

"Multiple Sclerosis—Physio-therapy on One Patient." BW, Si, 1200 ft.

Fox, J. T.

"Birth of a Caterpillar." C.

Gaines, Norman D.

"Dissecting the Fetal Pig"—A three part series. C, Si.
Part I—"The Digestive System." 28 min.
Part II—"The Male Urogenital System." 22 min.
Part III—"The Circulatory System." 21 min.

Made in association with Prof. Asher E. Treat, City College of New York.
"The Full Lower Denture Implant." C, Si, 400 ft.

Films available from Norman D. Gaines.

Glover, Donald, M.D.

"Marjolin's Ulcer, A Preventable Threat to Life and Health." C, Si, 400 ft.
"Functional Repair of Mandible Following Bone Loss." C, Si, 600 ft.
Films available from Dr. Donald Glover.

Goodman, Leo

"Femoral Hernia Repair." C, 800 ft.
"Piloric Stenosis"—Three cases: 5 months, 3 months and 5 days old.
"Trigger Finger." C, Si, 200 ft.
"Inguinal Hernia." C, Si, 800 ft.
"Mitral Stenosis." C, Si, 600 ft.

Harding, F. R.

"Operation for Hirschsprung's Disease."
"Operation for Hernia."
"Subdural Hematoma."
Films not available.

Hier, Leslie E., Jr. and Beiter, J. J.

"Prefontal Lobotomy." C, Si, 825 ft.

Huish, A. L.

"Smith-Peterson Orthoplasty." Si.
"Pulmonary Valvotomy." Si.
"Auricular Appendectomy." Si.
"Coarctation of the Aorta." Si.

Jankelson, Bernard, M.D.

"Physiology of Incision, Mastication and Deglutition." BW, Si, 800 ft.
Made in association with Dr. Rushmer, Department of Physiology, University of Washington.

Kaplan, Seymour

"Atresia of Nasopharynx"—Complete plastic repair. Si, 500 ft.

Kobrak, H.

"The Inner Ear." C, Si, 1250 ft.
Available from Medical Film Guild, New York.

Landi, Victor R.

"The Jaenechon-Collison Hip Prosthesis." C, Si, 500 ft.
"Procedure for Bone Marrow Examination Using Turkel Needle." C, Si, 450 ft.
Films not available.

LeDoux, Pierre

"Right Hemispherectomy." Si, 300 ft.

Leonard, Robert A.

"Repair of Old Laceration of Upper Lid." C, Si, 600 ft. (Spanish and English titles)
"Correction of Entropian and Extropian." C, Si, 500 ft.
"Surgical Repair of Massive Destruction of Lids." C, Si, 500 ft.
"Removal of Tumor with Wheeler Repair of Lower Lid." C, Si, 500 ft.
"Combined Cataract Extraction and Sclerotomy." Si, 200 ft.

"Use of Tantalum Gauge in Removal of Orbital Tumor." C, Si, 400 ft.
Films available to members of the medical profession from Dr. Alston Callahan, Prof. Ophthalmology, Medical College of Alabama, Birmingham, Alabama.

Lower, George G.

"Marine Invertebrates."
"Coral Gardens of Bermuda." 1200 ft.
"Marine Life of Cape Cod." 1350 ft.
Films are available from Mr. Lower, Westtown, Pennsylvania.

MacKay, Hunter J., M.D.

"Cervicodorsal Sympathectomy." C, Si, 300 ft.
"Operation for Trigeminal Neuralgia." C, Si, 250 ft.

Markham, Dorothy

"Techniques in the Routine Examination of Ocular Motility." BW, Si, 1200 ft.
Available from Ophthalmological Foundation, 314 E. 14th Street, New York 3, New York.
"Cataract Surgery." C, Si, 400 ft.

Moon, Irwin A.

"Dust or Destiny." C, 1600 ft.

Neilson, F.

"Lobectomy." C, S.
Available to members of the medical profession from Newton Bigelow, M.D., Comissioner, Department of Mental Hygiene, State of New York, Albany, N.Y.

Proetz, Arthur, M.D.

"Smoke Streams in Nose and Throat Models Indicating Pathways of Respiratory Air Currents."
Not available.

Roger, Henry

"Waterbury Hospital Campaign." S.
Available from Waterbury Hospital, Waterbury, Connecticut.
"The Pioneers." S, 45 min.
Available from Southern New England Telephone Company.

Scott, Thomas W.

"Intra Oral Pharyngeal Structures and Their Movements." C, S, 20 min.
Available from Central Office Film Library, U. S. Department of Agriculture, Office of Information, Motion Picture Service, Court 5, South Building, Washington 25, D.C.

Stiff, Hilary P.

"The Challenge." C, S.
"A Story of Cerebral Palsy."

Sturgis, Warren

"We Speak Again—The Rehabilitation of Laryngectomized Patients." 600 ft.
"The Circulation in the Fetus and in the Newborn." 300 ft.
"The Bone Bank." 1000 ft.
"Gram's Stain—A Demonstration of the Technic." 400 ft.

"Migraine—Its Diagnosis and Treatment." 900 ft.
"Surgical Treatment for Patent Ductus Arteriosus." 400 ft.
"Surgical Treatment of Hirschspring's Disease." 550 ft.
"Esophagogastrostomy for Achalasia of the Esophagus." 900 ft.
"Resection of Vagus Nerves—Trans-thoracic Approach." 500 ft.
"Arytenoidectomy—Open Approach for Bilateral Abductor Paralysis." 500 ft.
"Pyloromyotomy for Infantile Pyloric Stenosis." 500 ft.
Films available from Sturgis-Grant Productions, Inc., 314 East 46th Street, New York 17, New York.
"The Embryology of the Eye (2 Parts)" 1600 ft.
Film available from William L. Benedict, Secretary, Academy of Ophthalmology, Rochester, Minnesota.
"The Male Sex Hormone." 900 ft.
Available from Schering Corporation, 2 Broad Street, Bloomfield, New Jersey.
"From One Cell." 600 ft.
Available from American Cancer Society, 47 Beaver Street, New York, New York.

All films are 16 mm. unless otherwise noted. Film lengths are stated in minutes or feet as reported. BW—black and white, C—color, S—sound, Si—silent.

II. Meetings Reported at Which Scientific Films Were Shown

1949

Second World Festival of Films and Fine Arts, Knokke, Belgium, June 18-July 10, 1949.
Tenth Exhibition of Cinematographic Art, Venice, Italy, August-September 1949.

1950

American Association of Anatomists, New Orleans, La., April 5-7, 1950.
Second International Cultural and Documentary Film Conference, Berne, Switzerland, May 13-31, 1950.
American Medical Association, San Francisco, Calif., June 26-30, 1950.
Eleventh Exhibition of Cinematographic Art, Venice, Italy, August 15-September 15, 1950.
Gardone Festival, Gardone, Italy, September 1-11, 1950.
Seventh International Congress, International Society for Cell Biology, New Haven, Conn., September 4-8, 1950.
American Chemical Society, Chicago Section, Chicago, Ill., September 5-9, 1950.
American Physiological Society, Columbus, Ohio, September 14-16, 1950.
First Exhibition of Exchanges with the West, Turin, Italy, September 22-29, 1950.
International Documentary Film Festival, 1950 Canterbury Celebration, Christchurch, New Zealand, October 16-28, 1950.
American College of Surgeons, Boston, Mass., October 23-27, 1950.
International Photographic Exhibit, Bologna, Italy, November 1950.
American Society of Zoologists, Cleveland, Ohio, December 27-29, 1950.

1951

American Association of Anatomists, Detroit, Michigan, March 21-23, 1951.

III. Reported Publications, Other Than the Journal

Ballerini, L. and Scandone, F.

Microcinématographie en contraste de phase. *Micr.* (Paris), 1:M162-164, 1949. (16 mm. camera with separate motor drive used with Galileo phase microscope).

Buchsbaum, R. et al.
Report of the Cinema Committee, American Society of Zoologists. Anat. Rec., 106: No. 3, March 1950.

Dragesco, J.
La technique micro-cinématographique en Grande-Bretagne. *Micr.* (Paris), 2:109-112, 1950. (Brief descriptions and comments on Canti, Hughes, Mitchesen and Weston).

Eastman Kodak Co.
Visual aid sources, motion pictures and film strips. (Available from your Kodak dealer).

Elias, H.
Principles of scientific teaching film production. *J. Assoc. Am. Med. Coll.,* September 1950.

Morrison, J.
Motion picture instruction in colleges and universities. *J.S.M.P.T.E.,* 55:265-278, 1950

Kuhl, W.
Die technischen Grundlagen der Kinematischen Zellforschung. Dec. 1949. Lange, Maxwell and Springer, Ltd., London, England.

Stubbs, T. H., Ruhe, D. S. and Griswold, G. H.
The use of an automatic projector for a collateral film course in community health.
J. Assoc. Amer. Med. Coll., 25:53-58, 1950.
C.L.M.L., 18:523, 1950.

C. Graham Eddy, Chairman
Harry E. Morton, M.D.

A Report of the Committee on Judging of Medical and Biological Motion Pictures*

DURING the past several years, motion pictures made by members of the Biological Photographic have been exhibited during the Convention. For a number of years, the still pictures made by BPA members have been judged by a committee and suitable honors have been awarded for outstanding work. Three years ago, in 1948, a committee was organized to judge the motion pictures which were submitted for showing during the convention. Those who received awards of recognition for their motion picture work were pleased and

* Submitted July 6, 1950, Harris B. Tuttle, chairman, C. Graham Eddy, Leo C. Massopust, Ralph Creer.

it was thought advisable to continue the judging each year. This was repeated in 1949 and 1950.

In our first two attempts to classify and judge films, we were immediately aware of the difficulty of fairly judging and selecting the outstanding films shown. It is easy enough to say that one apple is better than another, but it isn't so easy to say that an apple is better than a peach or that a peach is better than a pear. Because of the wide dissimilarity of subjects submitted, it was difficult for the judges to reach their decisions.

It was therefore the opinion of the judges that if a program of judging was to be continued each year, it would be wise to establish a pattern for judging wherein a recommended practice could be carried on for many years regardless of the group of judges chosen.

It might be well to state at this point that the judges have always been keenly aware of the responsibility imposed on them in trying to fairly evaluate the relative merits of the pictures entered. Each person entering films rightly feels that his film has some particular merit which may or may not be readily evident to the judges and should this be overlooked, they feel badly about it.

During the past two years, many films entered have been the result of work by professional producers as well as by our regular members who are normally employed in the making of all types of still and motion picture records as part of their routine hospital work.

It has been obvious to us from the beginning that if we were to have one general classification in which we accept both amateur-made as well as professionally-made films and judge them on equal basis, that in nearly all cases, the professionally-made films emerge on top. In many cases, this might discourage the average member who possibly makes only two or three or four motion picture records a year and does it as part of his routine job and on a limited budget.

The Committee wishes to encourage in every way possible the showing of both amateur and professionally-made films so that the greatest number of our membership can benefit by the experience of our membership. We recommend that there should be two general classes of entry: (1) films made by the average medical department photographer in a hospital or university medical school, and, (2) films made by the professional producer. We recognize that there may occasionally be some dispute as to whether a person is a professional or not, but believe that in broad terms one can say that any individual who maintains a studio for making medical and biological motion pictures, who goes out and does this work for any doctor or hospital or university that may employ his services and who has facilities for producing the type of picture

that is usually classified as a professionally-made film because of special effects and sound and other features which are related to this type of picture, that his films can be classified as professionally-made. Professional producers are further identified as having a certain budget to work on in making a picture and more or less follow a planned scenario routine in delivering the finished picture. Such films usually have one or more duplicate prints made either for sale or for general distribution.

In the first class, the work of members could be classified into perhaps four major groups.

a. *Techniques:* surgery, laboratory procedures, endoscopic photography, etc.

b. *Clinical:* motion pictures of patients to show deformities or defects; before and after operative procedures.

c. *Scientific Records:* pictures made with special apparatus such as cinephotomicrography, cineradiography, endoscopic, and any other pictures made through cystoscopes, laryngoscopes, gastroscopes, etc.

d. *Nature:* botanical or zoological or entomological subjects.

In the second classification, would be all films made professionally. There would be no effort made to break these down into classifications nor would there be any effort made to judge them. If the professionals wish to have their films judged, the necessary rules and regulations for classifying and judging such classifications could be set up. An award of Recognition can be given to commercial producers if it seems desirable to do so.

It is proposed that these recommendations, if adopted, be published in the Journal so that persons entering films will know in advance the various categories under which their films may be classified and also they will know in advance the basis on which the judges will judge their films and in this way, perhaps they will be able to learn to better evalute their own films in advance and thus edit future films so that they will be greatly improved in editing. It is suggested, however, that when persons specify which class their film is to be judged under, they name only one class and this class should best represent the general intent of the picture. For example, a picture might be basically a clinical type of subject and yet in the continuity of the film, there might be occasion for having 100 feet or more of good cinephotomicrography. If the film is basically a clinical picture, then it should be entered as such and will be judged on its general excellence as a clinical picture, and the cinephotomicrographic pictures would be judged as part of the clinical record. However, if the maker of the film felt that the best part of his film was the cinephotomicrography, it would be wise for him to enter it under Scientific Records and then

only the cinephotomicrography part of the picture would be judged in that category.

Motion pictures, like still pictures, are not difficult to judge so long as the judges confine their evaluation to like things. For this purpose, it is only necessary to break pictures down into the various classifications that comprise the picture structure as follows: (1) General Picture Interest; (2) Plot, Purpose, or Theme; (3) Picture Structure, Timing, Directing, Editing; (4) Photography, which includes, Lighting, Camera Technique, Exposure; (5) Titling or use of Sound.

In judging an entertainment type of film, it is assumed that since the directing and photography are done professionally, that these should be good. However, the picture interest and general value of the film from the standpoint of entertainment is the important item to be considered in judging the films, and could be given a weight of 50%, photography 30% (this to be broken down into lighting, camera technique, and composition, allowing 10% for each item), directing to be given 20% and this to be broken into casting, editing, timing, and possibly resourcefulness of the director. In using these values the judges should consider half of the maximum of allowable points as average. In other words, a picture that had entertainment value that was just about average would get 25%, etc. in classifying the other categories. The picture that is, say, above average, could win 40%. An exceptional film that would be classified as a four-star production could win 45 to 50 points. If the photography was the really tops in each of the categories, it could win with a maximum of 25 to 30 points.

Now if we apply this type of breakdown to films made in the medical and biological fields, we could change the weight percentagewise in order to favor the factors of most value or concern to our membership.

Where to put the weight of percentage value of films judged in the biological field might cause considerable debate. In discussing this with a number of individuals, we have found that nearly everyone has his own specific point of view. However, we think that at the present time members of the BPA are chiefly interested in improving their photography and their general photographic technique.

Therefore, the Committee recommends that we place photography first and let that carry 50% of the total weight. This can be broken down into Lighting, Camera Technique, Exposure, Choice of Background or Originality, and Special Effects, allowing about 10% for each of these five factors. An alternative value would be to give Photography 45% allowing 15% each for Lighting, Camera Technique, and Exposure. Planning, Directing, and Editing could comprise

Group 2 and 10% could be allowed for each of these factors. General Picture Interest could comprise Group 3 with a value of approximately 10% and Titling and Sound could comprise Group 4 with value of about 10%. Using these value of 50, 30, 10 and 10 as a basis for judging about 80% of the weight of the judging is placed upon the factors which represent the skill of the biological photographer. The 10% for Picture Interest is small indeed and perhaps concerns chiefly the person for whom the picture was made. Therefore, from the standpoint of members in the BPA who are interested primarily in improving their photographic ability, it seems fitting and proper that 80% of the weight be placed in this direction.

It must be remembered that this is purely arbitrary value and if at any time the membership or board feel that more weight should be given to Picture Interest and less to Photography, or that more weight should be given to Planning and less to Photography, the relative percentages can be changed so that they are 40-40 or 30 for Photography and 50 for Planning. We suggest that in making an initial start and using a percentage breakdown basis for evaluating films, that the above figures be tried at least for one year if there are indications that it is not properly balanced, then steps can be taken to make the necessary changes for 1952.

In the case of the BPA, I think we are concerned chiefly with evaluating our members' films fairly so that they may know wherein they are weak and wherein their work is strong. If a person consistently gets only 1% allowance for exposure under Photography, he will know that his exposures are bad and that this is one department in which he can find room for improvement.

In the event that these recommendations are approved by the BPA Board, we suggest that ballots similar to the one shown on page 41 be printed so that the judges will merely have to fill in the title of the picture and percentage assigned to each of the various factors.

As pointed out earlier in this report, it is recommended that professionally-made films be not judged, but would merely be shown during the convention programs. Further, we suggest that when films that are made by manufacturers of photographic or any other equipment used in the biological sciences are shown at the Convention, that such films also be classified along with the professionally-made films. It is also further recommended that in cases where BPA members are associated with manufacturing companies that they be permitted to exhibit any films that they have made privately and which were not made for the organization they represent for use in advertising or sales promotion. In other words, the committee does not want to impose any hardship upon commercial members of the organization who may in their spare time make pictures which might be classified in one of the named categories, and

MEDICAL AND BIOLOGICAL FILM VOTING BALLOT

Name or Title of Film	Photography 50%				Directing 30%			Picture Interest 10%	Tilting or Sound 10%	Total
	15%	15%	15%	5%	10%	10%	10%			
	Lighting	Camera Techniques	Originality	Exposure	Planning	Directing	Editing			
1.										
2.										
3.										

which are worthwhile exhibiting and are not intended for commercial purposes. On the other hand, films which are definitely made by commercial organizations to demonstrate products or techniques in using products should be classified as professional pictures.

For the past two years, Certificates of Merit have been awarded to persons whose films met with a certain degree of excellence. This is the only tangible evidence that a person entering a film receives in recognition of his work. The Certificate is usually signed by the chairman of the judges and the president of the Society, and is suitable for framing. We suggest that this practice be continued in making awards to future winners in our exhibition.

We believe that these recommendations will form a working basis for making a sound start in the evaluation of our members' films. We recognize that it isn't a perfect solution and that many of our own members will disagree on the placing of weight in evaluating films. As pointed out previously, these values are arbitrary and can be changed any time to shift the emphasis of weight into any desired factor in the breakdown. We hope that the Board will look favorably upon these recommendations and approve their use for this year at least until further data can be obtained to support any recommended change.

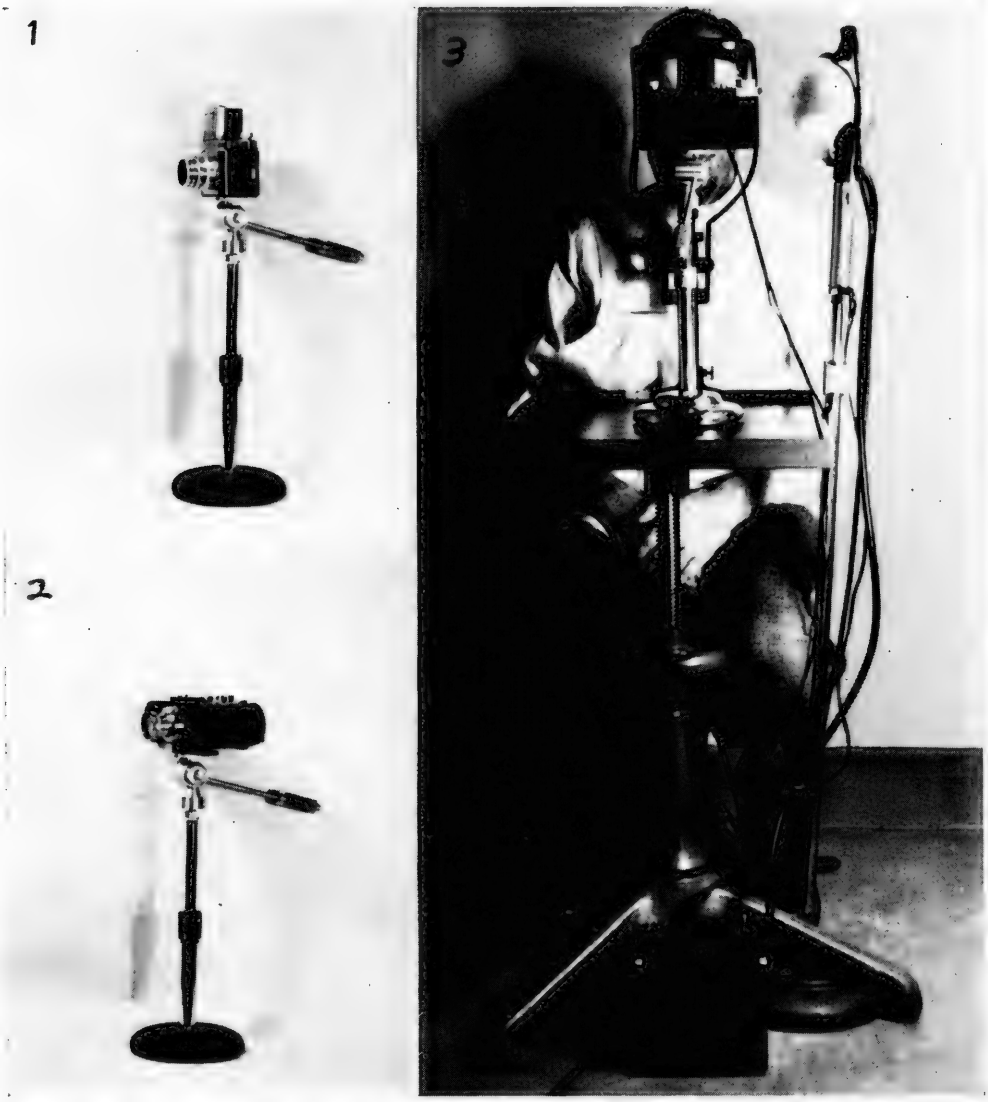

Figure 1. Lumax stand with reflex type miniature camera. Figure 2. Stand with camera and sliding, copying attachment. Figure 3. Table-top stand and floor stand showing camera and electronic flash in position for close-up photography.

An Adjustable Stand for Camera and Flash Gun

MARGARET MARKHAM*

A SIMPLE and inexpensive adjustable chrome stand, with a regular panhead, has been designed for table-top and close-up photography. (Fig. 1)†

The camera alone, or with a sliding, focusing, copying attachment, may be mounted on it. (Fig. 2) The Lumax stand has a weighted base but is compact enough to permit use of the camera at very close range to the subject. The height of the stand can be adjusted through a range of from 8 inches to 13 inches and it can be locked in desired position by means of a knurled knob.

The same type of stand, but with an extension range from 35 inches to 65 inches has been utilized for mounting an electronic flash gun, with the stand resting on the floor. This enables the photographer to use the gun either at the camera position or to one side, thus freeing the hand which might ordinarily have to hold the gun. The floor stand also has a weighted base but is light enough to be moved easily from one side of the table to the other, or from room to room. (Fig. 3)

An intermediate size stand can also be obtained, permitting an extension ranging from 18 inches to 32 inches.

* Department of Ophthalmology, New York University-Bellevue Medical Center, New York, N.Y.

† Designed and manufactured by Lumax Manufacturing, 489 Sixth Avenue, N.Y. 11, N.Y.

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Martin G. Schneckenburger

As a small boy Martin G. Schneckenburger became so interested in photography that he spent the first money he earned for a camera. This interest continued throughout his life, and he was a member of the BPA for 16 years. From 1919 until 1930 he was Chief Photographer for the Buffalo (N.Y.) Society of Natural Sciences and the Buffalo Museum of Science. During World War II he became a photographer for the Bell Aircraft Corp., remaining with the firm until 1945.

He was a resident of East Aurora, N.Y., and died on June 26, 1950.

15,000 R.P.M.

Captain Harry R. White (center), photographic engineer at the U.S. Air Force School of Medicine, Randolph Field, Texas, using a modified Cine-Kodak Special to photograph a dental drill revolving at 15,000 r.p.m. The tooth (a real one) and the drill are hidden behind the mechanism at the right. Leslie D. Case (left), chief photographer of the photo section, is photographically recording the speed and temperature readings of the drill which register on the square instrument at the left of the head of the dummy.

Concerning the technical problems of medical research photography, Captain White estimates that fully 50 per cent of the jobs require modification of standard equipment, or design and complete fabrication of new equipment.

For instance, the dental laboratory was recently doing some research to determine the accuracy and quality of dental drills, and the best speed at which to operate them. The researcher had plenty of still photographs of drills in operation, but they left much to be desired. Captain White was consulted and in a short time he and his staff had rigged up a motion picture camera with sound track that successfully photographs dental drills at various speeds up to 15,000 r.p.m.

An electronic power pack was constructed capable of flashing an electrical discharge flashtube 20 times per second. This was done by rectifying 110 volt A.C. to 110 volt D.C. and stepping up the voltage to 2000 volts. The current was stored in low capacity condensers and discharged through the tube to give a flash of 1/24,000 second (41.6 microseconds). It was necessary to remove the cover glass from the tube and devise a blower system to keep the coils cool. By this means it was possible to increase the life of the tube from about the usual 10,000 flashes to over 100,000 flashes.

The drill, no larger than the lead in a pencil, appears almost the size of a human body on the screen, and the head of the drill itself can be magnified to cover the entire screen. When turning at 15,000 r.p.m. it has almost the appearance of a still picture.

Association News

Chapters

Chicago Chapter: A very interesting meeting was held on January 16 at which Dr. Robert Schreck, Assistant Professor of Pathology, Northwestern University, Medical School, and Director of Tumor Research Unit, Veterans Administration, Hines, Ill., and Mr. John Ott, Jr., Winnetka, Ill., whose time-lapse work is well known, spoke on "The Application of Cine-Micrography in the Study of Living Cells." The attendance of close to 60 indicated the general interest the meeting received.

The February 20th meeting was held at the University of Illinois, R & E Hospital. Mr. O. T. Bright, General Service Manager, Bell & Howell Company, spoke on "Equipment Maintenance". Mr. Ralph P. Creer, Chapter President, presented a discussion on "The Role of the Clinical Photographer in Civilian Defense."

New York Chapter: At the first meeting of the new year, held on January 17, the chapter had its largest turnout for a Symposium on "Fundus Photography", arranged by Miss Margaret Markham, Department of Ophthalmology, New York University Post-Graduate Medical School. The Symposium included the following speakers and subjects: Dan Gordon, M.D., New York Hospital, "The Importance of the Fundus Camera in Clinic and Office"; Isadore Givner, M.D., New York Eye and Ear Infirmary and New York University Post-Graduate Medical School, "Fundus Photography as an Aid in Teaching Ophthalmology"; Mr. Walter G. Kramer, Carl Zeiss Company, "The Development of the Zeiss-Nordenson Retinal Camera"; Miss Markham, "Techniques in the Use of the Fundus Camera"; and Mr. Howard Trimby, Director, Ophthalmic Division, Bausch & Lomb Company, "The New Bausch & Lomb Retinal Camera".

On February 21 the Chapter met at its usual place, i.e., Cornell University Medical College, where two speakers appeared to discuss the following subjects: "How Can We Help in the Civil Defense Program?" and "How Can We Use Our Skills to Best Advantage?" Mr. Ralph P. Greer, well known BPA member, led the discussion on "The Role of the Biological or Medical Photographer in the Civil Defense Program", whereas Dr. Morris Jacobs spoke on the Civil Defense Program of New York City. Dr. Jacobs is Deputy Director of Medical Emergency in New York City. He represented the Director, Dr. Marcus Kogel.

On March 21st Mr. Sam C. Dunton, Chief Photographer of the New York Zoological Park, Bronx, N.Y. spoke on "Zoological Photography at the Zoo and in the Field". He was introduced by Dr. Roman Vishniac.

A special meeting of the chapter was held on April 4 at which two demonstrations were given at Cornell University Medical College. Mr. Jack Godrich, Dept. of Endocrinology, demonstrated specially designed apparatus for cinephotomicrography, and Mr. Percy Brooks, Chief of the Department of Photography, demonstrated his technic for the reproduction of X-rays.

Northern Ohio Chapter: The Chapter got underway in 1951 with a meeting held January 10 at City Hospital, Cleveland, Ohio. Mr. Donald Dean, Professor of Biology at Baldwin Wallace, gave an illustrated talk entitled "Chromosones and Genes". Also, Mr. J. Speyer of the Opplem Company, New York, demonstrated a photomicrographic outfit made in Milan, Italy by the Galileo Company.

At the February 7 meeting, held at the Photographic Department of the Cleveland Clinic, members showed their choice slides and discussed the various aspects of their making. An introductory session was held on certification of medical photographers, to be continued at subsequent meetings.

Southern California Chapter: At the January 18, 1951 meeting, the celebrated Kenneth Stager, Curator of Ornithology and Mammalogy at the Los Angeles County Museum, gave an illustrated lecture on his research pertaining to the "Scrub Typhus", conducted in Burma and India in collaboration with the U.S. Army. In addition, Mr. Stager showed slides made on an expedition to the famous canyon Barranca de Cobre in Mexico with LIFE photographer Ralph Crane in 1950.

On February 15th the Chapter met at Children's Hospital, Los Angeles, to hear and see a two-part program given by Mr. Zane Price. First, Mr. Price gave a worthwhile discussion on time-lapse motion studies as applied to scientific subjects and then presented a demonstration of a photomicrographic unit and time-lapse motion pictures on leprosy.

MEMBERS

DR. ROMAN VISHNIAC, New York City, won first prize in the Annual Competition of the New York BPA Chapter held in December, 1950 at the American Museum of Natural History. The competition was conducted as a part of the Second Annual Photographic Salon and Equipment Exhibit of the New York Chapter. BPA members were well represented among the other award winners. Mr. Sidney Shapiro, Chief, Medical Illustration Division, V.A. Hospital, Bronx, New York, was given second prize. Honorable Mentions went to Mr. Percy W. Brooks, Chief Photographer, Cornell University Medical College, New York; Mr. Lester Bergman, Bergman Associates, Brooklyn, New York; Miss Margaret Markham, Dept. of Ophthalmology, N.Y.U. Bellevue Medical Center;

Mr. Julian A. Carlisle, Rockefeller Institute for Medical Research. The judging panel included two national officers of the Association, Dr. Oscar W. Richards, President, and Mr. Lloyd E. Varden, Secretary. Mr. Jacob Deschin, photographic editor of the New York Sunday Times, collaborated with Richards and Varden.

MR. RALPH P. CREER reports that he has a new assistant. Mr. Owen Johnson, formerly audio visual material advisor in the Audio Visual Education Service of the University of Minnesota, has joined him on the American Medical Association staff.

DR. PAUL A. VAN PERNIS, Director of Laboratories, Butterworth Hospital, Grand Rapids, Mich., kindly sent us a reprint of his paper entitled "Medical Photography" which appeared in *The Modern Hospital,* Volume 76, #2, Feb. 1951. The paper was prepared in collaboration with Mr. Delbert L. Price, formerly at the Butterworth Hospital.

Miss Barbara Best, of the British Columbia Cancer Institute, Vancouver, B.C., has reported that in January 1951 a Medical Photographers Association was formed in British Columbia. They now have ten active members who meet once a month.

DISCUSSION

Many scientific journals have a section called *Letters to the Editor.* These may be ideas, or contributions that can be covered within a few paragraphs, or may be constructive criticism of the Journal, or of the Association. Would you like to have an opportunity to express your views? If so, we will have a similar section in our Journal.

In another place you will find a report of several years of the activities of the Motion Picture Judging Committee which makes recommendations for future judging procedures. Do you approve of the suggestions? Shall they become official policy? How would you improve this program? Your officers would like to hear from you, especially from our members who may not be able to come to the convention this year. No unsigned communications will be considered, but the writer's name will be omitted from publication when that is requested. Send your material to the Editor.—OWR.

NOTICE

The *National Society for Medical Research,* 186 N. Wabash, Chicago, Ill., has requested that we publish the following notice: "Five dollars will be paid for each photograph accepted for publication in a new book to be entitled "Animals Make Medical Magic". The photographs must show animals used for research and will be selected on the basis of public appeal to lay readers. Pictures of all types of experimental animals are wanted. Backgrounds should indicate laboratory surroundings whenever good composition permits."

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"Symposium of Cavity Illumination Techniques". Part 1. Dr. Brian Stanford.

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Suggestions for Contributors

Manuscripts should be sent to The Editor, Journal of the Biological Photographic Association, 70 Alton Road, Stamford, Conn.

All material will be retyped for the printer, but it will aid the Editor if the manuscript is typed with wide margins—not less than 1½ inches. The original and not a carbon copy should be submitted.

References: References may be given as footnotes or, if numerous, may follow the context. They should be given in the following forms:

Book—Valasek, Joseph. *Introduction to Theoretical and Experimental Optics.* 1st ed. New York, John Wiley & Sons, Inc., 1949.

Article in periodical—Carman, P. D.: "Photogrammetric Errors from Camera Lens Decentering." *Journal of the Optical Society of America.* Vol. 39, No. 11 (November, 1949), pp. 951-954.

Tables: Tables should be typed on a separate page and should have a caption which will explain the data without reference to the text.

Illustrations: Wherever possible illustrations should conform to the following proportions:

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Full page illustrations should not be less than 6.7 inches by 9.5 inches. Others should not be less than 4.25 inches by 6 inches.

Except for graphs, charts, and drawings, illustrations should not be lettered. Indicate lettering on an overlay or on a separate sketch.

Illustrations should be unmounted. Where they should be combined indicate the arrangement on a separate sheet.

Legends should be typed on a separate sheet and keyed for identification.

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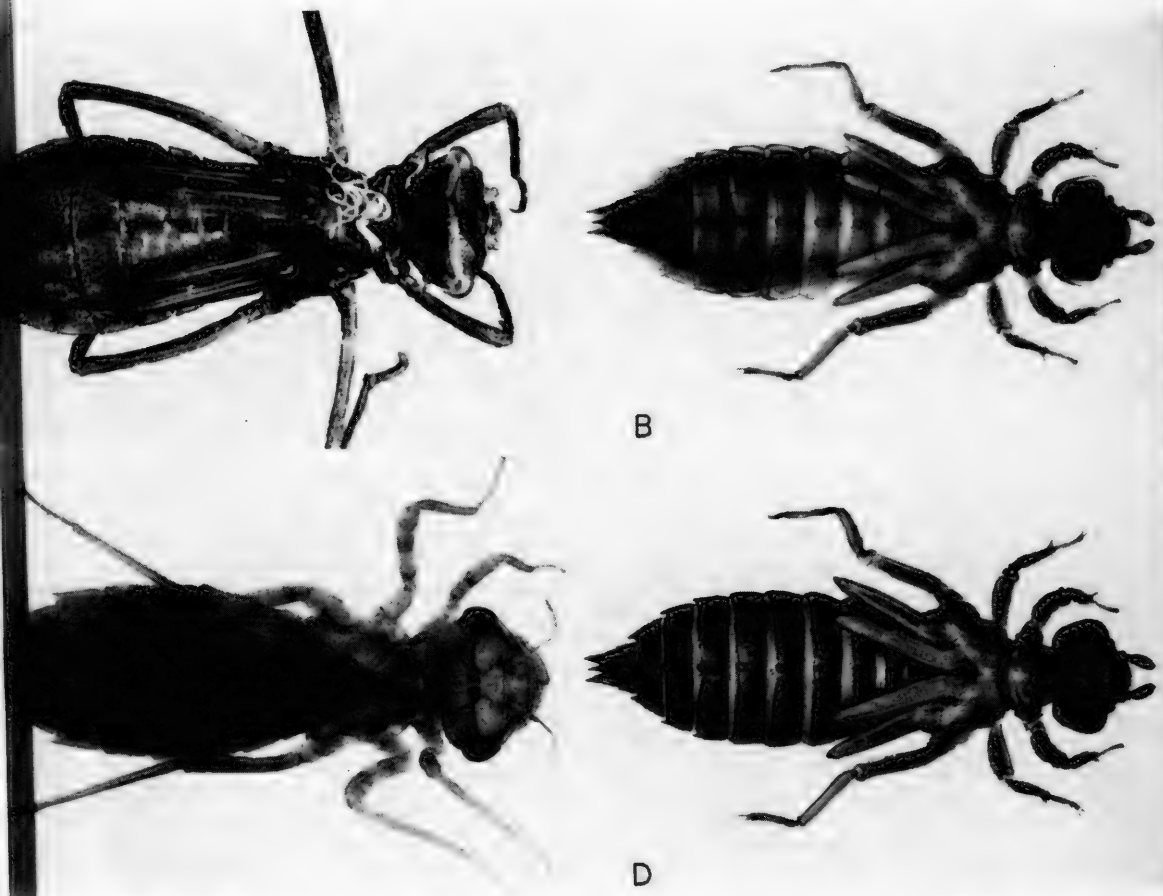

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Arthur L. Smith

May 1951

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Black-and-White and Kodachrome Copying of Radiographs†

H. LOU GIBSON, FBPA*

THE mechanical aspects of copying radiographs are simple and well understood by the photographer in a medical photographic department. He usually has the copying equipment on hand. Thus, his technique is established. There are, however, a few problems, which may be called sensitometric, that are overcome in one way or the other by the experienced photographer. For this paper it is proposed to systematize the solution of these problems as a convenience to the advanced worker and as a help to the beginner.

The major portion of this paper will deal with copying radiographs for black-and-white lantern slides and prints, as this is the most usual application. Then, for the benefit of the radiologist not having full photographic facilities, the making of 2-inch x 2-inch Kodachrome slides from radiographs will be discussed. The latter technique is also useful for the department photographer who wishes, for the sake of uniformity, to include Kodachrome slides of radiographs in a set of clinical records in color.

Black-and-White Copying

The photography of any subject involves recording a range of brightness as degrees of density on the negative. On a bright sunny day, for example, the highlights are over a hundred times brighter than the shadows. This range is well within the recording ability of an appropriate negative material with latitude left over for exposure variations. In copying radiographs the task is complicated by the fact that the subject has an extreme brightness range. Because of the needs in making radiographic images, X-ray films are designed so that there is often a thousand times more light coming through the thin areas than the dense areas.

This range has to be encompassed by the film upon which the intermediate is to be made for printing the final slide or print. This range can be accommodated by a long-scale negative material—provided the exposure is accurate.

The range of densities on the radiographs has to be compressed from 1000 to 1 on the original to 100 to 1 on the intermediate. This means that all the density differences between various areas on the radiograph have to be reduced in proportion; the intermediate therefore has to appear flat or soft.

†Best paper award 1950 Annual Meeting.

*Medical Division, Eastman Kodak Company, Rochester, N.Y. Received for publication December 21, 1950.

Figure 2. The contrast of the copy here is increased somewhat and detail held in the dark and light areas by broad dodging and printing in. However, the contrast is still low, especially in the shadows and highlights.

Figure 1. An even, over-all, compression of the tone scale results in a flat, and hence unnatural looking copy. Subject shows unilateral tuberculosis of the hip with consequent rarification of the bone on the affected side.

In making a final slide it is possible, with careful technique, to expand this 100 to 1 printing range of the intermediate back up to a 1000 to 1 image range. It is a matter of straightforward care, then, to make a satisfactory slide. Producing prints is another matter, because a good, well-developed print has a reflection range of only about 50 to 1. This is not quite as bad as it seems, however, because the human visual process does not demand the range from prints that it expects from transparencies. Nevertheless, special procedures are usually required in making prints.

The first problem in copying radiographs, then, is the making of an intermediate. This can and must have detail in both the thin and dense ends of the original range. If slight density variations in either end of the intermediate are not plain, the final result cannot be expected to show the details of the original. The fault can be traced to incorrect exposure or overdevelopment of the intermediate film.

Once a satisfactory intermediate has been made it is relatively simple to print a good slide. On the other hand, the making of a paper print may require compromises, and these constitute the second problem. To understand this, consider that the original 1000 to 1 range has to be compressed to about a 50 to 1 range without the results looking flat. An approximate analogy may be helpful in judging how the prints can be made. This analogy will also be helpful in making intermediates from contrasty radiographs, in which the tone range may be more than 1000 to 1, causing them to be difficult to record satisfactorily for printing.

First, it is desirable to think of the ranges in logarithmic terms. In a logarithmic scale the value of 10 goes to 1, 50 to 1.7, 100 to 2, 200 to 2.3, 1000 to 3, etc. These will be recognized as the figures used to express density. Such a scale is not only more compact but it also describes density in values compatible with the visual response of the human eye.

In order to better understand the reproduction problems, we can liken the radiograph to a ruler 3 inches long, and the print to the case, 1.7 inches long, into which the ruler has to be placed. The various densities of the radiograph then become the divisions on the ruler. How can the ruler be fitted into the case?

One way would be to evenly compress the length of the ruler to 1.7 inches. This would compress the divisions equally. But suppose the divisions then become too close together to be readable even though our psychophysical processes in effect permit us to look closer at the smaller ruler. This would parallel a flat copy-radiograph in which the various tones are not far enough apart to look "natural", Fig. 1.

A possible solution would be to compress the ruler unevenly—say by squeezing both ends and leaving the middle less changed. Then the middle divisions would be fully legible while the end ones would be close together and not so distinct. This is what happens in a good straight copy print of a radiograph when the exposure is made for the middle tones. The technique is applicable, of course, when the diagnostic detail lies in the middle tones of the scale of the original radiograph, Fig. 2.

Another common procedure is that of exposing for the dense areas or the thin areas in printing, depending upon the region in which diagnostic details lie. This, figuratively, is compressing one or the other non-important end of the ruler. Such a solution is valuable as it insures that the area of interest is clearly recorded. However, the overall appearance of the copy will be somewhat unnatural because one end of the scale is scarcely recorded, Fig. 3. Again, there may be significant detail in both ends of the scale that cannot be recorded in this way. In this case other means have to be employed.

There are many occasions when the character of the copy can be improved by dodging during printing. (Additional exposure is given the dark parts by means of extra light behind them or by means of more exposure time through appropriate holes in a black card. Similarly, less exposure can be given the thin areas through less transillumination or by "holding-back" with a black paddle.) Nevertheless, dodging should not be done indiscriminately. The reason for this can best be seen by returning to the ruler analogy.

"Dodging" the ruler into its case means that certain sections of the divisions are compressed. For example, the first ¼ inch at each end may be left relatively untouched. Then the next ¼ inch sections are compressed sufficiently, leaving the middle also unchanged, Fig. 4. This is all right, provided there are no details (in the corresponding radiograph) obscured in the divisions that are compressed. Thus, the effectiveness of a dodged copy should be judged by the radiologist or by a photographer familiar with what the radiologist wants to show. A fetish should not be made of showing a "skin line". Sometimes, dodging to accomplish this obscures diagnostic detail in areas not quite as dark (in the original) as the skin and background regions.

The analogy can also throw a little light on the handling of contrasty and flat originals. The former represent rulers that are longer than 3 inches and the corresponding intermediates are developed to a lower contrast than those from normal radiographs for the necessary compression. The latter represent rulers shorter than 3 inches and the corresponding intermediates are developed to a higher contrast to effect less compression.

Figure 3. The selection of a more contrasty paper is indicated by the test print of Figure 2. When this is done, the entire tone range becomes difficult to maintain. "A" is a straight print exposed for the shadows; note lack of highlight detail. "B", is exposed for the highlights with consequent loss in the shadows.

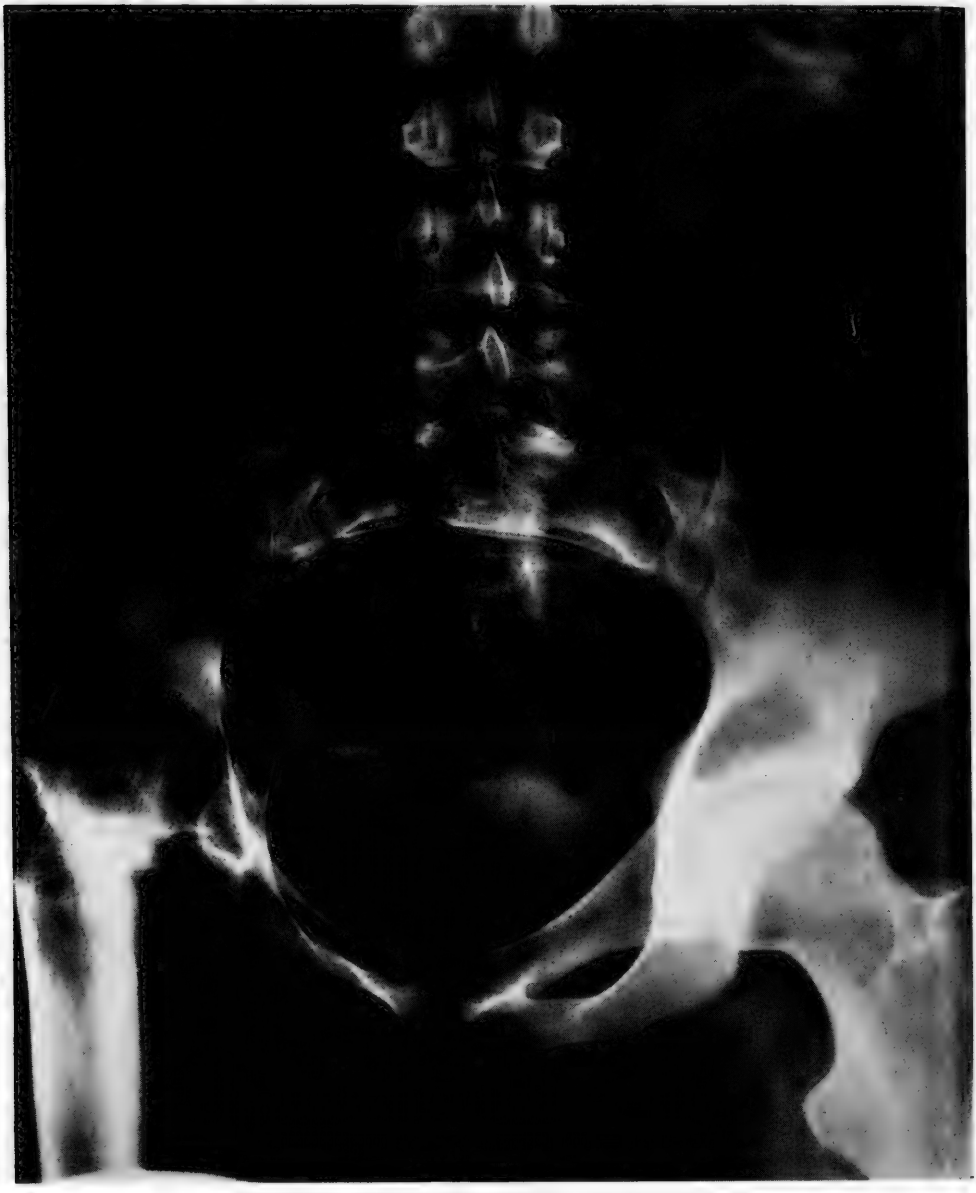

Figure 4. By differentially dodging with pencilled and cut-out tissue paper in the contact printer, parts of the tone scale are compressed here. This results in an acceptable overall contrast plus significant detail.

Technical Considerations: Obviously, the first requirement for the intermediate film is a long recording scale. The author must necessarily confine his remarks to films he has worked with, accordingly he can only recommend, in the sheet film classification, Kodak Ortho-X Safety Film. This has a satisfactory recording scale of about 1000 to 1 over a wide range of development contrasts. Thus it is able to accommodate contrasty radiographs if developed to a low gamma and also flat originals if developed for longer times. The use of a coated lens is desirable.

A suggested method of working is to sort the radiographs into contrast categories for specific intermediate development times and also into general density classification for exposure simplification. A set of black masks should be provided to adapt originals of various sizes to the illuminator and preclude flaring marginal light. Room lights should be turned out for the exposure to prevent reflections in the shiny surfaces of the radiographs and to keep light off dodging cards (see below). The following table, based on the use of the Kodak Cold-light X-ray Illuminator, summarizes the approximate technical factors. The exposure times (in seconds) are for an aperture of f/16; the development times (in minutes) are for Kodak Developer D-76 in a tank at 68°F.

Type of Radiograph		Exposure Time in seconds for f/16	Development Time in minutes for Kodak D-76 at 68° F
Density	Contrast		
Low	Low	1/25	21
Medium	Low	1/2	21
	Medium	1/2	13
High	Low	4	21
	Medium	4	13
	High	3	6

Intermediates made in this fashion will seldom need dodging when they are to be printed as slides. However, because of the limitations in prints, adjustment in the tone values of the intermediate may be needed if it is intended for print making, when copying radiographs of normal contrast. Judgment in this respect can only be learned by experience guided by an understanding of the problems. In general, it is usually necessary to brighten with additional localized

illumination, or to expose for a greater time, with a hole in a black card, those areas in the original that appear too dark to the eye to show detail clearly. Sometimes, thin areas that seem fogged can be held back to advantage with a black paddle during the exposure of the intermediate.

Dodging during the making of prints is also necessary on many occasions. In general, the most accurate and consistent method, particularly when several copies are to be printed, is to employ a contact printer of the professional type. Tissues can be cut for such a printer and pencilled and placed on the dodging-glass shelf beneath the intermediate. Once appropriate cut-outs (for regional printing-in) and pencil shading (for holding back) have been made, it is relatively simple to run a batch of prints. The tissues can be filed with the intermediate for reprinting.

For enlarging, the usual paddles and cut-out cards can be employed when dodging. Notes on the dodging technique can be filed with the intermediate. It is necessary to use a clean enlarger lens (preferably a coated one), otherwise flare light from the thin background areas of the intermediate tends to spill into the light areas of the print and degrade the brilliance. It is extremely important to mask the negative carrier to the edges of the intermediate.

Kodachrome Copying

There is already a widespread application of this technique because of the ease with which 35-mm and Bantam color films can be handled. However, the results have been somewhat unsatisfactory because of the inability to record the full tonal range of the originals and the increased contrast of those tone regions that are recorded. A "straight" copy shows that detail is missing in one or both ends of the original tone scale, because exposure must be given for the general tones of the area of interest—making two slides necessary when significant details exist in both ends of the original.

It is interesting to extend the ruler analogy to this technique. The case is about 3 inches long but the ruler is stretched to about 4 inches by the color film contrast. The ruler then projects at both ends of the case and is buried externally in black plush at one end and in white plush at the other. With short exposures it is possible to push the ruler out of the white plush so that the enlarged divisions at that end can be read in the case—but the other end of the ruler becomes further buried in the black plush. Similarly, long exposures uncover the end of the ruler in the black plush, but bury the opposite end deeper in the white plush. There is only one way of modifying the present technique to overcome these difficulties with a compromise: the ruler and the case are both compressed to about 2.1 to 2.2 inches.

In terms of copying with the color film, this is accomplished by pre-exposing the Kodachrome frame to the uncovered illuminator first and then recording the radiograph by means of double exposure. The pre-exposure should be such that the maximum density to which the frame can be processed is limited to about 2.1. Thus, the first "picture" that is taken is a very much underexposed one of the lighted illuminator glass. To study the effect of the pre-exposure alone, the second exposure (for the radiograph) should be foregone for a frame; the "underexposed" record of the glass can be seen as a faintly lighter patch than the edges of the transparency. It can be read in a densitometer and should have a density of 2.1 to 2.2. The pre-exposure, therefore, is not sufficient to affect the subsequent rendition of the light areas of the radiograph, but it does prevent the dark areas from becoming "pushed into the black plush." The radiograph exposure, obviously, should be that which is ordinarily given for a rendition of the light tones in the original radiograph, the pre-exposure takes care of the dark tones.

When a densitometer is not available, the illuminator can be calibrated for pre-exposures by making a series of trial pre-exposures alone. In general, the pre-exposed frame should be just noticeable when viewed against a blue sky. When their level has been found, exposures to radiographs should be added in further tests, making the radiograph exposures that which would ordinarily be given to the light areas. The final transparencies are judged as to the rendition of dark parts. Only those frames should be judged that show full detail in the light areas; then, if the pre-exposure is insufficient, the dark regions will be "blocked up," if overly sufficient, the dark regions will appear weak or "washed out."

The transparencies resulting from a correct pre-exposure are a great improvement over straightforward copies. They should not be looked upon as "diagnostic" slides, but rather as "demonstrative" illustrations for a lecture. It should also be realized, that a carefully controlled black-and-white slide may provide a more faithful copy from many originals.

Technical Considerations: Working with the Kodak Coldlight X-ray Illuminator, the author has found that a suitable pre-exposure is obtained at 1/25 seconds at f/11. The second exposure for the radiograph is 2 seconds at f/11 for a good original.

Some extremely flat radiographs show an improvement in the copy when no pre-exposure is given. However, if it is desired to demonstrate their flatness, the pre-exposure would provide a good record of the condition. Occasionally, the result from a moderately flat radiograph indicates the need for a curtailed pre-exposure—about ½ stop less is all that need be allowed for such an original.

The type of Kodachrome Film selected will depend on the illuminator adopted. An X-ray illuminator is bluish and the regular (daylight type) film should be used in conjunction with it. Tungsten lamp illuminators may give better results with the indoor film. Color compensating filters over the camera lens are valuable for making fine adjustments in the tint of the results. In general, a weak magenta filter (Kodak Light Color Compensating CC-05M) should be used to preclude the greenishness that otherwise may be present.

The right amount of pre-exposure is quite critical; should the camera shutter vary in exposure time for a given speed setting it would be better to work out a means for giving a time exposure. This can be done by placing a neutral density filter having a density of 2.0 over the lens, or fogging and developing a large sheet of film to this density for the illuminator. Because of the film characteristics, the resulting reduction of 1/100 in the pre-exposure illumination requires more than the expected 100 times the pre-exposure time. Therefore, 6 seconds at f/11 is suggested for a neutral density filter and further experiments for a fogged film.

Exposure Suggestions

In arriving at exposures for the radiographs, a photoelectric exposure meter is valuable in both black-and-white and color copying. A comparative reading technique is suggested rather than an absolute method. In the latter, reading the dark areas does not cause sufficient deflection of the needle; reading the lightest areas leads to varying results; reading the middle tones is unreliable because it is difficult to decide consistently what constitutes such a region, especially when copying is done only occasionally. A comparative method eliminates these difficulties to a large degree and can be established as follows.

For the black-and-white technique, typical "Low," "Medium," and "High" contrast radiographs should be selected as "standards" for the contrast groupings mentioned previously. Variation in density between a standard film and a new film in its group can then be allowed for with the exposure meter (as explained below), provided the new intermediate is given the same development of that for the standard. The correct exposure for each of the standard originals is found by experiment and recorded—suppose a typical one is 3 seconds at f/16.

The standard film is placed on an illuminator similar to the one used for copying the new original. The two films are compared visually and an area in the new film is found that, in the opinion of the photographer, should be recorded in the intermediate to the same density as a certain area in the respective copy of the standard. For example, a good copy of the mouth region in a given skull radiograph might be judged to need the density of the cervical spine region

in the copy of a chest-film standard even though the comparing area of the skull radiograph may obviously be lighter or darker (because of defects in the quality of the original) than the comparing-area of the chest film.

Meter readings of the two comparing-areas are then made and the new film exposed in direct proportion. For example, the mouth region may show a deflection of 5, whereas the cervical region yields 10. Then the skull radiograph is given 6 seconds at f/16.

Comparing-areas should be selected on the basis of approximately the middle of the tone range of each new radiograph. Such a density may or may not correspond to the middle tones of the standard.

The value of the comparison method will be apparent when it is appreciated that in the absolute method based on "middle" tone readings the photographer tends to select a certain medium density for reading regardless of the nature of the original. This detached "middle" density may be taken to exist in the cranial area of a dark skull radiograph and in the mouth area of a lighter one, especially if the two are copied over a considerable calendar interval. Obviously, the two originals do not require the same exposure that would thus be indicated. Always having a standard for comparison eliminates the effect of the calendar and gives a more definite basis for exposures, because even should the photographer's judgment of a middle tone drift with time, he is unlikely to misjudge the required renditions of two comparing-areas immediately before him.

In copying with the Kodachrome technique, it will be found that a single calibrated exposure will yield a quite faithful reproduction of all radiographs. However, a dark original produces a dark slide and a light original a light slide. Therefore, to "improve on the original" some exposure variation is necessary. The variations will not be as great as the total range of those required in black-and-white copying. A definitely light radiograph will require about one half the exposure of the standard when the Kodachrome technique is adopted and the requirements of dark ones will range up to about three times the standard exposure. When an exposure meter is utilized, the lightest areas on the radiographs that show detail should be used as a basis for comparison. Such areas should all be in the lightest region of the Kodachrome transparencies; the preexposure will then permit accommodation of the dark areas of the radiographs.

Back Issues Needed

Copies of the following issues of our Journal are needed to complete a set for a library: volume 2 number 1, volume 4 numbers 2 and 3, and number 1 of volumes 11 and 12. A dollar and a quarter will be paid for each received by the Editor.

Cine-Photomicrographic Apparatus with Constant Temperature Chamber for Tissue Culture Studies

MACHTELD E. SANO† M.D., EDWIN S. GAULT M.D., and GEORGE S. HENNY M.D.

(With the technical assistant of C. THUR, J. DAVIES and R. GOODE)*

SANO and Smith (1) reported a simplified technique for tissue culture, utilizing a glass ring with 2 cover slips as the chamber, this in turn placed within an ordinary Petri dish for convenience in handling and maintaining sterility. It possessed the advantages of easy accessibility to, and a flat surface for microscope study of, the culture. Later Sano (2) developed a new and extremely simple method for fixing and staining the tissue culture in 12 hours, leaving the cultures in place. The desirability of obtaining a permanent cinephotographic record of the same cells during their development is obvious. A previous apparatus (3) developed during the early war years and in disuse for several years later, was taken as the skeleton upon which the new apparatus was built. Its compactness and its construction has elicited so much interest from all fields of research that we feel we should publish a memorandum of its construction.

The apparatus was built around our special culture cell, to permit the tissue culture to remain in its normal upright position. This required the inversion of the microscope in order to obtain high power photomicrographs, as otherwise the depth of the culture chamber interfered with any but extremely low magnification. Partly to decrease the length of the optical system and partly because a side arm viewing prism was not available, the camera was interposed horizontally by the intervention of a prism in the system. The camera is a Cine-Kodak special without lens and fitted to the apparatus by special adaptors. The light source is a standard Bausch and Lomb Ribbon Filament Lamp of the projection type. So far as the optical system is concerned there is nothing unusual about it other than its inverted position.

The constant temperature chamber has been fundamentally altered from the previous model. The sides and back portion are made of white Plexiglass. The front and top of transparent Plexiglass. The hollow base is made out of brass transite and houses nichrome wire electric coils producing the heat. These are controlled by a Fenwal Thermoswitch, 1. Furthermore in each corner and attached

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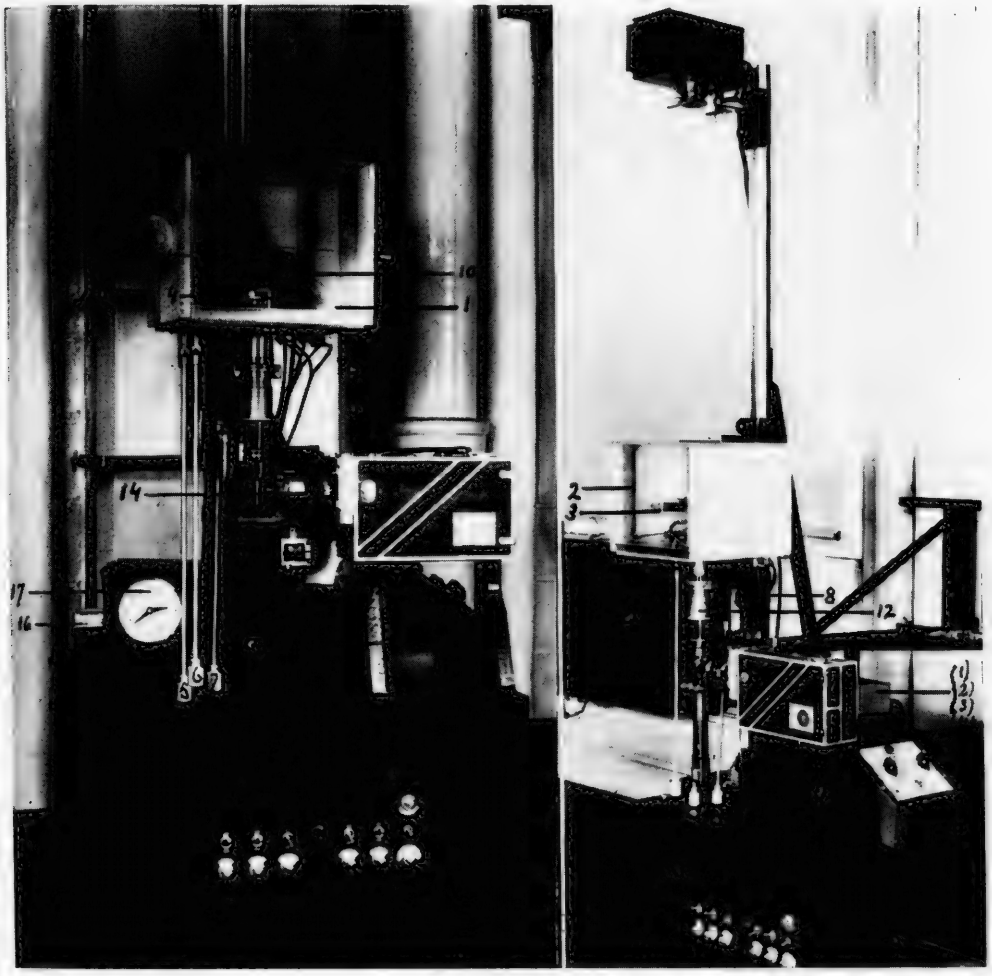

Figure 1. Cinephotomicrographic apparatus, 64.5 × 21.5 × 18.5 inches. A. Interval timer. B. Voltage regulator. C. Photometer.

to the plexiglass chamber but free from its base are four hollow ceramic resisters which augment the primary heating unit and assure a uniform temperature throughout (2). These resistors are connected in series and controlled by a Fenwal Thermoswitch also attached to the box 3.

On the base and about 3/16″ above it a mechanical stage, 4, is mounted which holds the tissue culture dish. This is operated by remote controls 5 and 6. The third control, 7, is the fine adjustment of the microscope. The coarse adjustment is made with the usual control marked 8. The diaphragm is controlled by a remote control lever 9. A resistance thermometer, 10, with a continuous self-

recording mechanism, fig. 2, (Micromax, Leeds and Northrup Company, Philadelphia) is introduced into the chamber so that any deviation from the constant temperature may be noted on the recording chart, and the cultural results interpreted accordingly. The new method of heating and the use of remote controls for all adjustments has obviated the necessity of the contrepoids of the original method.

A removable tube 12, readily detached from the microscope, permits the rapid change of objectives. It avoids the necessity of raising the constant temperature chamber and stage formerly necessary in the older apparatus. The reflecting prism 13, at the observer's position is unchanged except that the whole apparatus has been raised to eye level.

The greatest difficulty was encountered at first with transmission of vibration from the camera shutter to the microscope, and stage. It was finally solved by isolating a shutter, 14, from the microscope and the camera. This is attached by a metal support fixed to the reinforced concrete shaft of the wall of the building which was found to be conveniently situated just behind the apparatus.

Our previous interval timer was discarded for a more modern electronic interval timer 15, (for 150-V 60 cycle A.C. only 500 watts Electronic Controls, Inc. Newark 4, New Jersey Model 1029). It controls the drum to which the four cam-microswitches are attached which control the cycle. This consists of 1) advancing the film and opening the Cine-Kodak shutter. 2) turning on the light source. 3) operating the shutter 14. 4) turning off the light. 5) closing the Cine-Kodak shutter.

Due to a rather marked variation in the house current it was found necessary to interpose a constant voltage regulator. An electric counter, 16, registers the number of exposures. As we found it desirable on occasions to start the machine at different intervals a Telechron Selector Clock, 17, was hooked onto the whole apparatus. This can only be used for low power and after cells have been placed

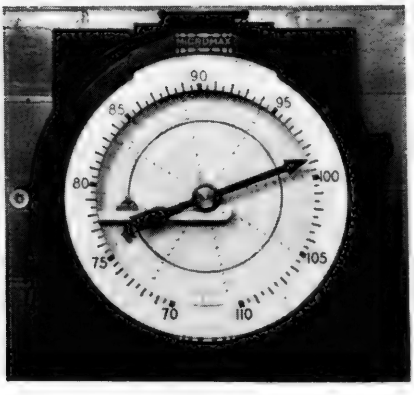

Figure 2. Micromax.

in focus. On high power, the focusing has to be too precise to permit photographing without being present. The apparatus is so simple to operate that it can be used for routine cinephotography of tissue culture. It is possible to use the new Bausch & Lomb long focus type of phase equipment with this apparatus.

This apparatus was built with a grant from the Division of Research Grants National Institute of Health, and the Agnes Barr Chase Cancer Research Foundation, Temple University Medical School and Hospital.

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Book Review

The New Leica Manual: **A Manual for the Amateur and Professional covering the field of Leica Camera Photography. By Willard D. Morgan, Henry M. Lester and twenty-four contributors. 423 pp. New York: Morgan nnd Lester. $5. 12th ed.***

For the doctor to whom professional medical photographic service is not available, the chapter on Medical Photography by Wayne M. Hull, M.D., offers numerous valuable hints toward the successful use of the Leica. In addition to pointing out the obvious advantages of the Leica such as portability, variety of accessory equipment, and the basic economy of 35 mm film, Dr. Hull includes a detailed coverage of fundamental principles which might well be read with profit by users of larger cameras.

The professional Medical Photograher will note with interest that this chapter is the longest in the Manual. In these fifty pages the author presents a well organized and fairly comprehensive survey of the problems met in this field. While the reviewers find certain statements dogmatic and perhaps misleading; such as some dealing with lighting and the choice of color backgrounds, Dr. Hull's chapter will serve as a useful guide to beginners in Medical Photography.

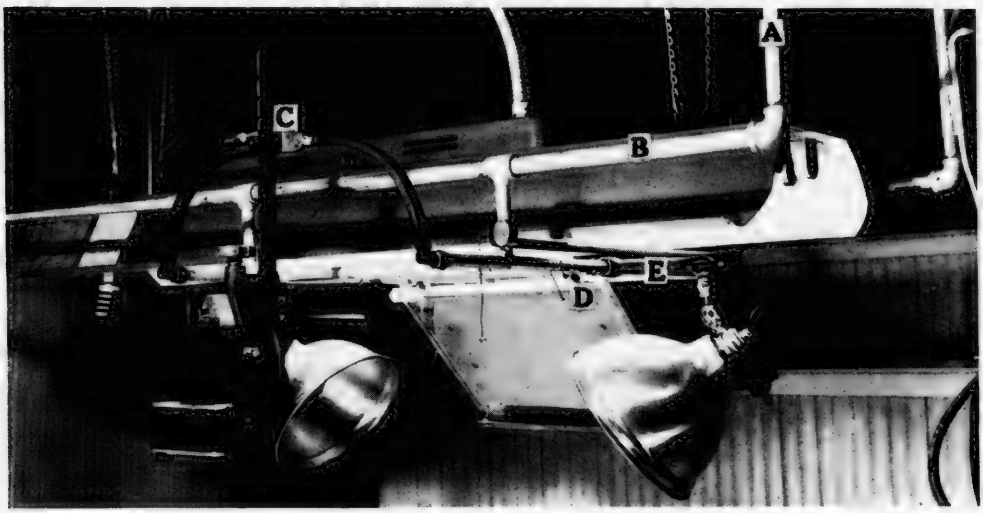
An appendage to the Medical Photography chapter, Photomicrography and Macrophotography at Variable Magnifications, was written by Mr. E. G. Keller of E. Leitz, Inc. This is a detailed discussion of the use of two valuable Leica accessories: the Aristophot and the Short Bellows Focusing Device.

* Section on Medical Photography reviewed by Sidney Shapiro and Percy W. Brooks, Veterans Administration, Bronx, N.Y. and Cornell University Medical College.

Cadaver Photography with Mirror-Device

S. M. RABSON, M.D.*

PHOTOGRAPHY of the cadaver is ordinarily done in one of two ways: either the table is tilted to the vertical or the cadaver suspended, or the camera overhangs the table on which the cadaver lies and the exposure is made in the vertical plane. In this laboratory the small size of the autopsy room, and the camera in use (Kodak Precision enlarger with Ektar lens—f.4.5, 127 mm. and 35 mm. adapter back) prevented the customary solution of the problem. Accordingly, an apparatus was devised in which a mirror is suspended at a 45° angle over the cadaver and the camera is mounted horizontally to photograph the image in the front-surface mirror.



The accompanying picture illustrates the device made largely of metal pipe. A is the supporting structure for B, the movable camera-morrow cradle, which moves the length of the cadaver on it. The camera-holding mechanism C may be extended laterally to increase the distance between mirror and camera. It also includes provision for raising and lowering the camera. The mirror-support D is mounted on two nuts, each provided with a female screw so that the angle of the support may be adjusted. From the mirror-support extend 2 side-arms E on which the lighting apparatus may be mounted. (The apparatus was made by Mr. Joseph Eichenseher, hospital engineer; the front-surface mirror was furnished by the Pittsburgh Scientific Art Glass Co., Tarentum, Pa.).

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A Specially Constructed Instrument for Taking Photomicrographs of Histological Preparations

ALBERT M. KESSEL and LAURENCE R. CRISP*

Introduction

THE problems and uses of photomicrography vary in different fields of research. This makes it necessary to design and construct special photomicrographic cameras and instruments to suit the needs peculiar to the many different research activities. Although there are many cameras available on the market, they lack the adaptability for efficient photographing of histological sections under the wide range of varying conditions desired. Attempts have been made by various investigators (1, 2, 3) to overcome the lack of commercially available equipment to satisfy their photographic requirements.

Four previous cameras of the same general type as the one herein described have been constructed at the National Institutes of Health for Drs. W. R. Earle, G. H. Algire, K. M. Endicott and A. B. Eschenbrenner. The first two have been described in the literature (2, 3). The latter two were basically similar to the present instrument with the exception of the microscopes used. Each embodied special features requested by the investigator in order to satisfy his own precise needs. The knowledge gained from their construction was valuable in the evolution of the design of this fifth instrument.

The basic purpose in the design of this instrument is to produce photomicrographs of histopathologic sections rapidly, efficiently and on a large scale with uniform high quality. The design of such an instrument requires the incorporation of the camera, the microscope lens system and the light source in a single unit to maintain the stable alignment of the various optical components. The instrument, however, must retain sufficient facility to cover all magnifications of the microscope lens system within the usable limits of microscopic and macroscopic photographic recording. It must also be capable of making photographs of varying sizes both in black and white or in color, suitable for publication in scientific literature or for illustrations and exhibits at scientific meetings and for permanent records.

* Pathological Technology Unit, National Cancer Institute, and Instrument Section, National Institutes of Health, United States Public Health Service, Bethesda, Maryland.

Credit is given to John M. F. DeBroske, Chief Instrument Maker, and Kenneth T. Bolen, Instrument Maker, Instrument Sections, National Institutes of Health, for their contributions in design and fine workmanship.
Received for publication Jan. 17, 1951. Presented at the 1950 Annual Meeting, Chicago.

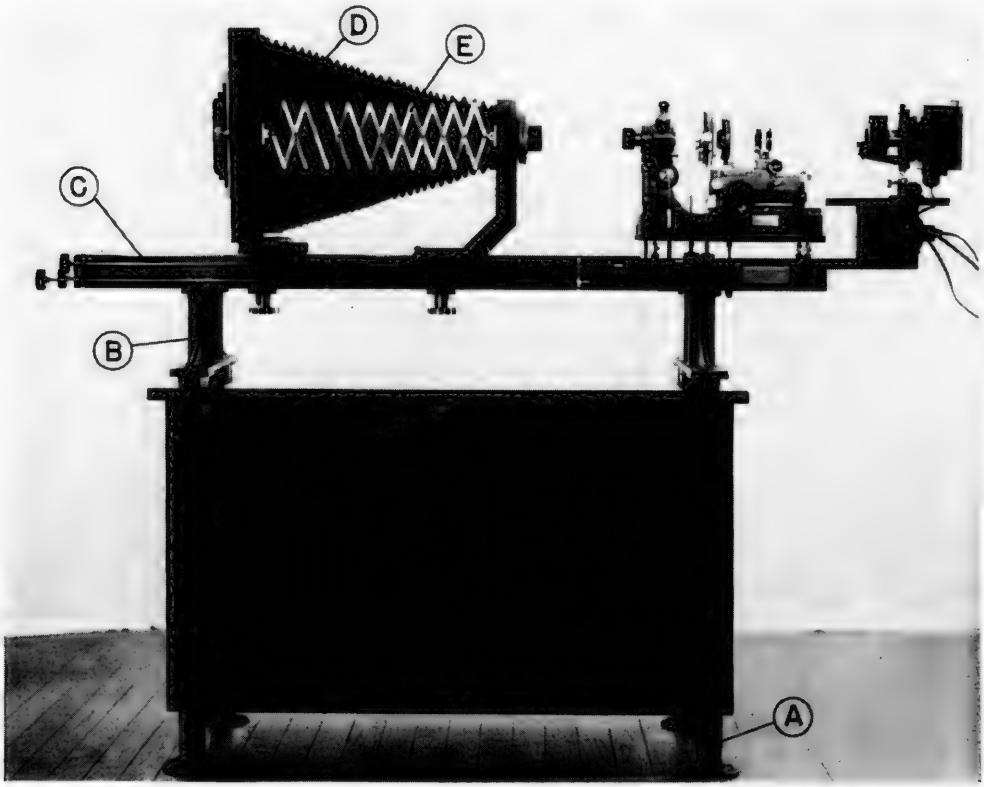

Figure 1. Complete assembly. A, Camera base; B, Support castings; C, Rails; D, Bellows; E, Pantograph.

Construction Details

Camera base and cabinet. In order to provide maximal stability the camera base, (fig. 1, A) was constructed entirely from steel pipe. Welding was employed for the fabrication. Standard pipe flanges were used on the bottom of each leg, mounted on loose threads for the purpose of leveling. These flanges were also utilized for the mounting of vibration dampers (Elasto-Rib, The Korfund Co., Inc., Long Island City, New York), caculated to isolate the camera from all objectional building vibrations. Because hollow pipe sections are prone to transmit vibrations, all sections were filled with sand.

The cabinet was constructed of wood, with provisions for ample drawer and shelf space to store optical and other accessories and film holders. After construction, it was lowered over the pipe frame. Four holes were provided in the cabinet top to allow the upper part of the legs to protrude for the mounting of the camera support castings (fig. 1, B).

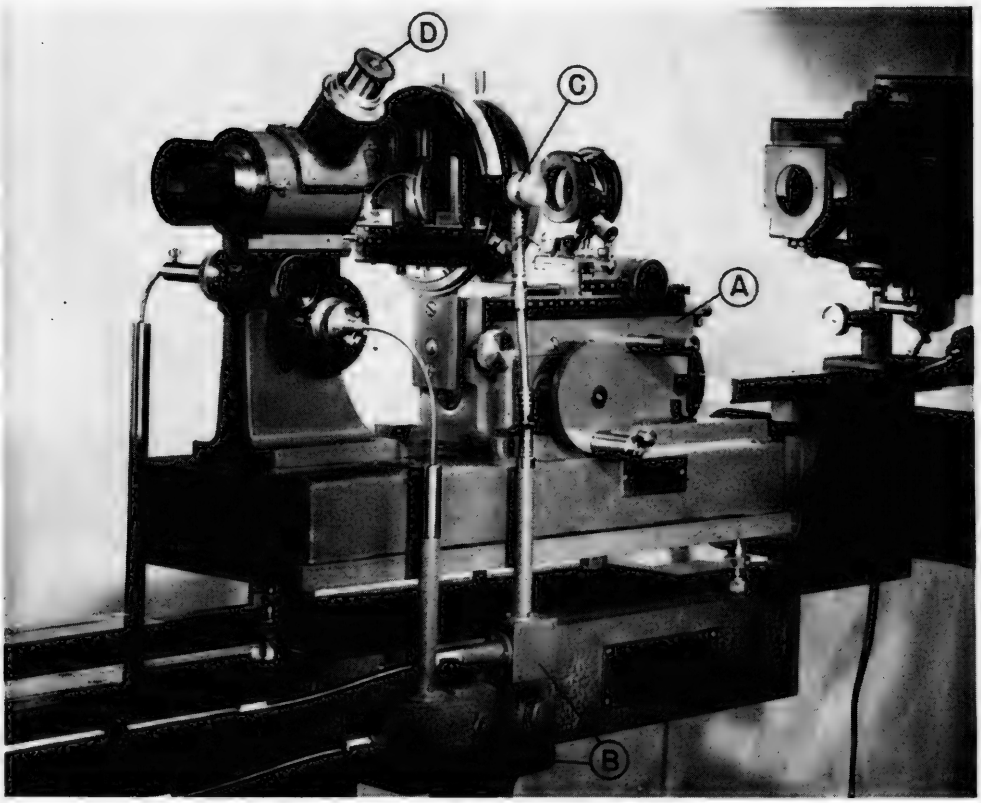

Figure 2. Microscope and Reduction Gear Boxes assembly. A, Microscope; B, Reduction gear boxes; C, Clutch; D, Side Observation Tube.

Camera Rails

Camera bed rails (fig. 1, C) were solid steel bars having a two inch by three inch cross-section. They were carefully mounted on the supporting castings to allow a four inch center spacing. On top of these rails were mounted two metal strips having the same width as the rails, and having sixty degree grooves machined in the top surface for V-rollers. These act as guides under the front and rear bellows supports. The strip nearest to the operator has a millimeter scale engraved on its outer edge, reading to 100 cm, accommodating the full bellows extension. It is utilized for adjusting the bellows extension for calculation of magnification and for providing for a predetermined magnification, depending upon the objective and the ocular used.

Microscope

The Bausch and Lomb Special 42-18-01 Photomicrographic Microscope (fig. 2, A) was designed especially for use in photography with transmitted light. It

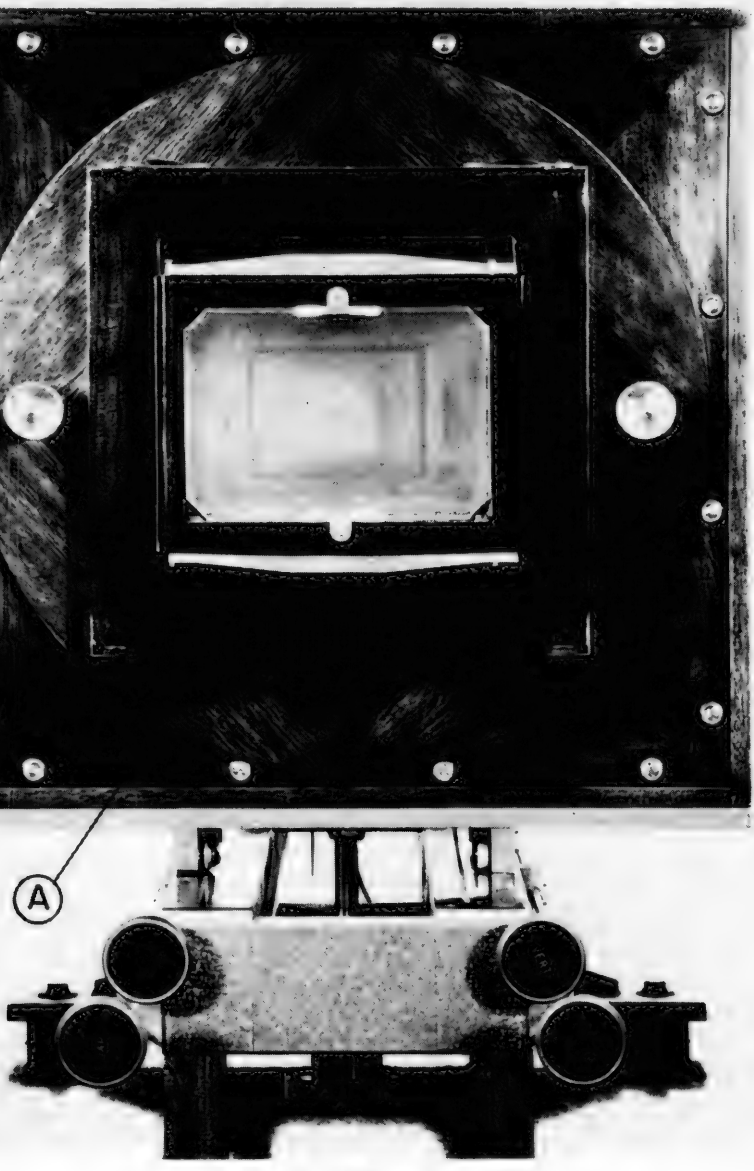

Figure 3. A, Rotary back.

was readily adapted to our camera enabling the use of standard microscope optics, thus making it possible to work at the wide range of magnifications, not so readily attainable in conventional instruments.

Camera

The camera was designed with a bellows (fig. 1, D) somewhat larger than is generally found on standard cameras, having dimensions of eighteen inches by eighteen inches at the large end and six inches by six inches at the smaller end, with a total free extension of 100 cm (specially constructed by United Camera Co., Inc., Chicago, Illinois). The bellows was supported throughout its entire length by pivoted rods attached to a pantograph (fig. 1, E) consisting of light rigid links, jointed in a parallelogram form, which were collapsible and self-supporting. The enlarged end of the bellows (2) allowed the use of a rotary back (fig. 3 A) which will accomodate all standard film holders of the Graflex type, from two and one-quarter inches by three and one-quarter inches to eight by ten inches. The use of this type of back obviates the necessity of rotating the stage on the microscope.

The fine and coarse focal adjustments, along with both horizontal and vertical movements of the mechanical stage, have been extended to the rear of the camera for convenience (fig. 3). Because of the extremely high magnification obtainable, it was found desirable to reduce the ratio of the controls to obtain a finer movement and a sharper image. The reduction gear boxes (fig. 2, B) were reduced in the following ratios:

(1) coarse adjustment 40:1

(2) fine adjustment 2:1

(3) vertical adjustment of mechanical stage 20:1

(4) lateral adjustment for stage 1:1

All of these adjustments have been supplied with clutches (fig. 2, C), so that the operator may focus on a specimen using the side observation tube (fig. 2, D) and the original adjusting knobs.

Sources of illumination of standard manufacture are mounted on a dovetail slide. Several complete units of varying intensity may be used mounted on their respective holders and pre-focused to facilitate rapid changing of light sources.

A Fish-Schurman "Zirconarc" (Fish-Schurman Corp., 230 East 45th Street, New York 17, New York) photomicrographic lamp with 40 watt bulb type ZO321 can be used when a more intense point source is desirable merely by constructing a base to fit the dovetail of the light source unit.

Operation

The operation of this camera allows a considerable range of magnifications with each combination of objective and condenser lenses because of the long range of bellows extension. For example: a photograph in color is taken 3¼" x 4", for use as a lantern slide, using a very short bellows. The same field can then

be taken in black and white of a larger size suitable for publication merely by extension of the bellows, without changing the objective and condenser.

The microscope objectives can be attached directly to the body tube or to a centering mount. The substage condenser can be centered by a centering adjustment of the condenser mount. The body tube may be converted to take the place of the rack and pinion focusing device, used ordinarily with other cameras for low-power work, by removing the eyepiece and its adapter. Because the 72 mm Microtessar is supplied in a regular photographic lens barrel by means of an adapter it can be fitted directly to the body tube, which has an inside diameter of 2½". For low magnification work the body tube can be entirely removed from the microscope stand by releasing a conical lock screw. Graduated dials and scales on the microscope are provided for every movement except the coarse focus and enables the operator to keep a reproducible record of the conditions under which the photograph was made. The substage condenser is calibrated accurately and adjustable to 0.001 mm.

The microscope is equipped with a side observation tube so that a slide to be photographed can be studied and the desired field can be located easily. This is of especial value in locating fields under very high magnification, particularly oil immersion. In addition, further studies of the slide and field can be made viewing the ground glass of the camera with the help of the extension rods. The added coarse extension focusing control (not available commercially) at the back of the camera is of great value to the operator in low-power work, since on many occasions, due to a long bellows extension, the coarse focusing knob cannot be reached. When it is desirable to photograph a particular field in a certain axis, this is accomplished by rotating the focusing screen instead of the mechanical stage. It also minimizes the likelihood of grasping the wrong knob and disturbing the alignment, the focus, or the object.

Summary

A photomicrographic camera was constructed in a single stable unit with flexibility to make photographs of varying sizes, types and magnifications of identical fields in color or black and white without changing the optical lens system. A rotating combination focusing screen photographic film and plate holder is utilized which allows direct selection on the camera of the angle of the microscopic field to be photographed instead of revolving the mechanical stage of the microscope. A maximum variable bellows extension of forty-five inches allows for a wide usable range of magnification with any given combination of objectives and eye-pieces. Greater facility in focusing is obtained by gear reduction units on each control. The extended controls permit selection of fields and final adjustment by direct viewing of the ground glass camera screen. A microscope to accommodate

all combinations: eyepieces, low power and high power lenses and objectives of standard manufacture. An observation tube is built into the microscope body to facilitate using high magnifications. Interchangeable light sources of varying intensities and adaptability can be utilized for all low power and high power work both in color and black and white.

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Boston Annual Meeting

Plans for the Boston Annual Meeting are complete. The meeting will be held at the Hotel Kenmore, Kenmore Square, Boston, on September 12, 13, 14, 1951. Vice President Graham Eddy has been working hard on the program and has secured an outstanding group of speakers for the meeting. This will be an Annual Meeting you cannot afford to miss. In addition to the benefits to be derived from attendance at the sessions, you will be in the heart of the area where history was made. Arrangements can be made by members and their partners to visit many of the historical spots in and around old Boston. This is a good opportunity to see the places you studied about in school (better late than never). Why not spend an extra day sightseeing, so as not to miss any of the meeting features? It will help planning if you make your hotel reservations immediately when you receive the registration cards. Get your material ready for the Salon, if you have not already done so. Even if you cannot come in person do send your best work. Let's have the best Salon of all time this year and show what you and the Association can do! Deadline August 15th at Boston. You will receive an application very soon. Use it! It is hoped that a lot of members who are rarely able to be at our Annual Meetings will be present this year. How about it, can we count you as present?

F. R. Harding, F.B.P.A.
Chairman.

Descriptive Photography of the Dragonfly

ARTHUR L. SMITH and MINTER J. WESTFALL, JR.*

INTRODUCTION

THE photography of insects as an inclusive field involves many interesting and sometimes difficult problems. Both still and motion picture methods have been employed in producing records for various purposes. Most commonly such photographs are used to depict such specific factors as habitat relationships, coloration, descriptive positions, or other details. Rarely, however, has photography been used to illustrate the taxonomy of an entire order. In the present instance, this method was selected to display the anatomical characteristics of the dragonfly in a forthcoming text.[1]

The experience encountered in photographing the various gross positions and dissected parts of the dragonfly demonstrated both the possibilities and the limitations of such work. There were several initial considerations involved in this project as well as the selection of specific methods of photography. For purposes of clarity, these will be discussed in the following order:—(1) Methods of illustration, (2) Reasons suggesting the choice of photography, (3) Test photographs to determine the feasibility of the process, (4) Equipment utilized, (5) The photography of various dragonfly parts, (6) Corrective treatments employed to insure reproducibility, and (7) Factors concerning the publication of the many photographic plates.

METHODS OF ILLUSTRATION

A large amount of the illustrations in the field of entomology involve macroscopic delineations. The small size and fine details of such forms often necessitate enlarged illustrations which are accurate and which demonstrate the characteristics which typify the perspective shown. To best meet these requirements, many past workers have selected various art media instead of photographic methods. There have been good reasons for this. In the use of half tone or ink drawings, an illustration could be produced which created a good line or tonal separation between all principal areas. Major characteristics could be emphasized irrespective of the perfection of the specimen and hair line details could be exaggerated to the point where they were reproducible. In the hands of a good scientific illustrator, entomological drawings extending from master "portraits" to simple ink sketches have been done in accordance with their planned use and method of reproduction.

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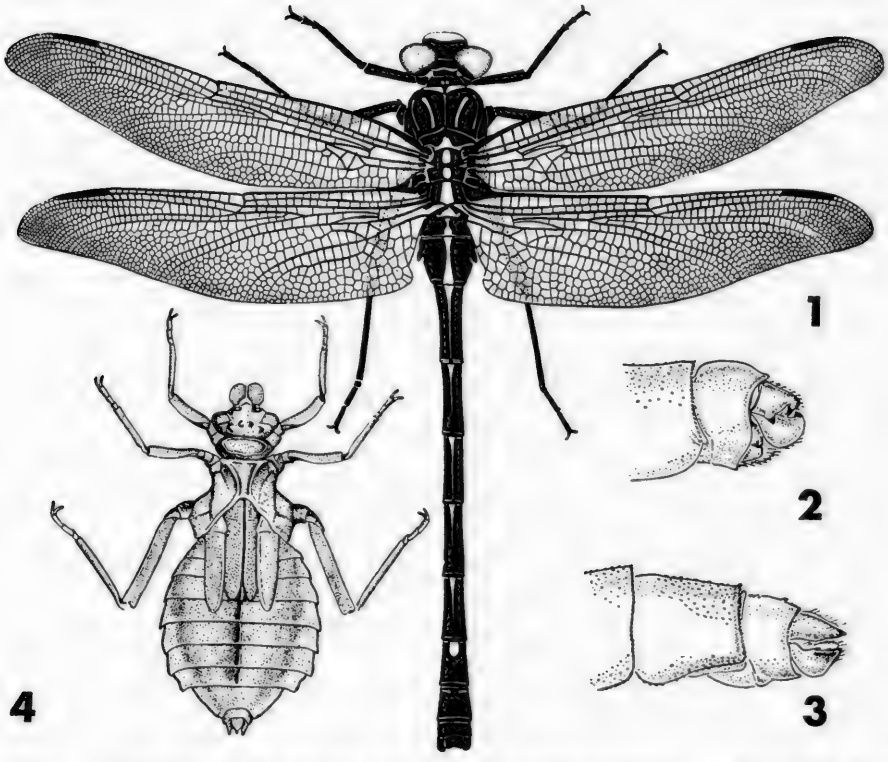

Figure 1. Conventional line and style drawings of dragonfly anatomy (1) dorsal view of adult, (2 and 3) anal appendages, (4) nymph.

Contrasted to this, the use of photography has normally required special equipment, complex methods of illumination, and the possession of relatively perfect specimens. Optical problems concerning depth of field and resolution have been difficult to overcome. In addition few workers were experienced in this form of work. In the past era, relatively few photographers have been interested in scientific illustration and a combination of such circumstances has usually resulted in the choice of an artist where an institutional staff was permitted the services of a single illustrator.

An examination of past literature in the field of entomology and specifically that related to dragonflies discloses a dominant use of ink drawings to illustrate anatomy taxonomically. Several characteristic illustrations of this type are shown in figure 1. It should be emphasized that one critical use of such drawings is to provide keys for identification. In many instances, minute detail is sacrificed in favor of the bold inclusion of those markings and conformations which may typify a given species.

THE CHOICE OF PHOTOGRAPHY

The selection of photography as the principal form of illustration for dragonflies in the present project was the result of extensive consideration. A primary factor was the existence of photographic facilities and the lack of an experienced artist. Furthermore, the factual accuracy of photography offered a means of obtaining a type of illustration which would appear in publication much as it did under the binocular. Such realism seemed desirable providing it was possible to secure photographs of sufficient quality.

It is a logical premise that individuals not skilled as artists may apply themselves to the processes of photography and provide a means of illustration. This does not imply that there is a lack of skill or diligence associated with photography, but that the methods do not require the inherent attributes of artistry. Furthermore, photography, if adequately routinized, provides a tremendous saving of time over the use of art methods. This often means an equivalent saving of money.

A full consideration of photographic illustration in the present problem therefore revealed (a) assurance of accurate proportions and areas; (b) a method which was ostensibly feasible by workers lacking art experience; (c) economy of labor and rapidity of production.

TEST PHOTOGRAPHS

In arriving at the final determination regarding the use of half tone photography, normal specimens and parts were photographed by various methods to aid in the selection of an exact technique. Both wet and dry specimens were used and the tests were made on 35mm, 3¼ x 4¼ and 5 x 7 inch films. Since a problem in miniature scale gradient illumination was involved, many different systems of lighting were investigated.

Due to the apparently inevitable presence of minute particles of debris on collection specimens, the dry process was handicapped whereas immersion specimens exhibited a somewhat better quality. Immersion also permitted a type of illumination in which the tone range could be sufficiently shortened to the point where most subjects were within the best response area of a normal panchromatic film. Although this effect often characterizes immersion photography, it was particularly useful in the present instance where subject coloration varied so greatly. Some specimens consisted of barely discernible gradients in the near black region. Other single specimens involved a long tone range. Many were of light tones only. This variation in subject coloration created a problem with regard to the most suitable background, but eventually white was chosen because it aided in the use of opaquing and in adding supplementary art work in later stages of the process.

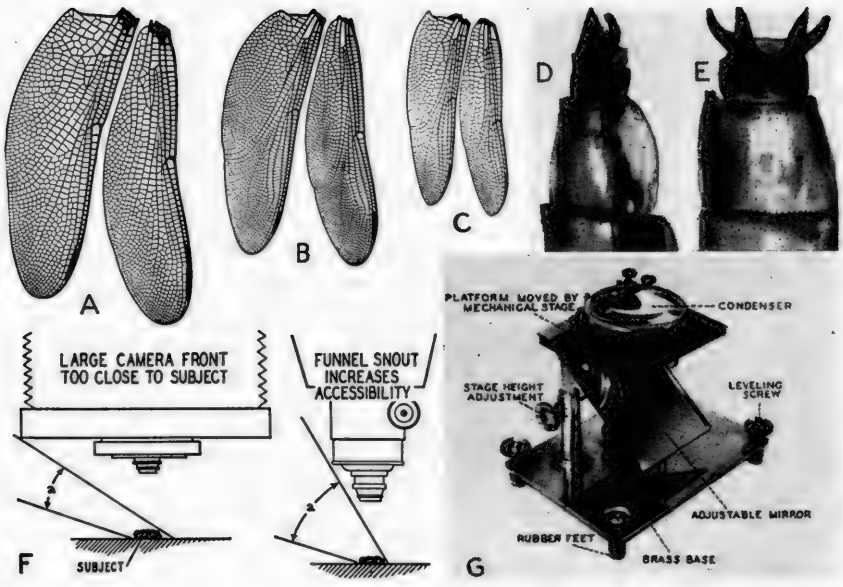

Figure 2. Test engravings, A-E. Wings reproduced in 2", 2½" and 3" lengths on zinc plates to determine minimum usable size. Fine screen copper halftone plates of the appendages suggested the need for good quality art corrections and the assurance of a high grade printing stock. F. A funnel snout increases the possible angle of illumination. G. A flexible low power stage.

One of the principal taxonomic characteristics of dragonflies is the venation of the wings and since the amount of such structural detail is extensive, photography was an obvious choice for this phase of the work.

Although all sizes of film produced usable results, 35mm was largely eliminated because of the fact that its enlargement inevitably decreased resolution and it could not be satisfactorily opaqued where needed, due to the small image size. Contact printing of larger film sizes eliminated these discrepancies and both 3¼ x 4¼ and 5 x 7 inch sheet film were used—dependent upon the size of the specimen being recorded. It is difficult to concentrate an adequate amount of reflective light on a specimen to obtain a focussable ground glass image and for this reason the smallest useable camera image is the easiest to photograph. Added bellows can easily increase image size but only at the expense of image brightness.

In considering the possible loss of detail due to engraving, test sizes of half tone and line plates were secured. These are shown in figure 2 A-E. It is interesting to note that even the smallest size wing silhouettes retained fairly good detail.

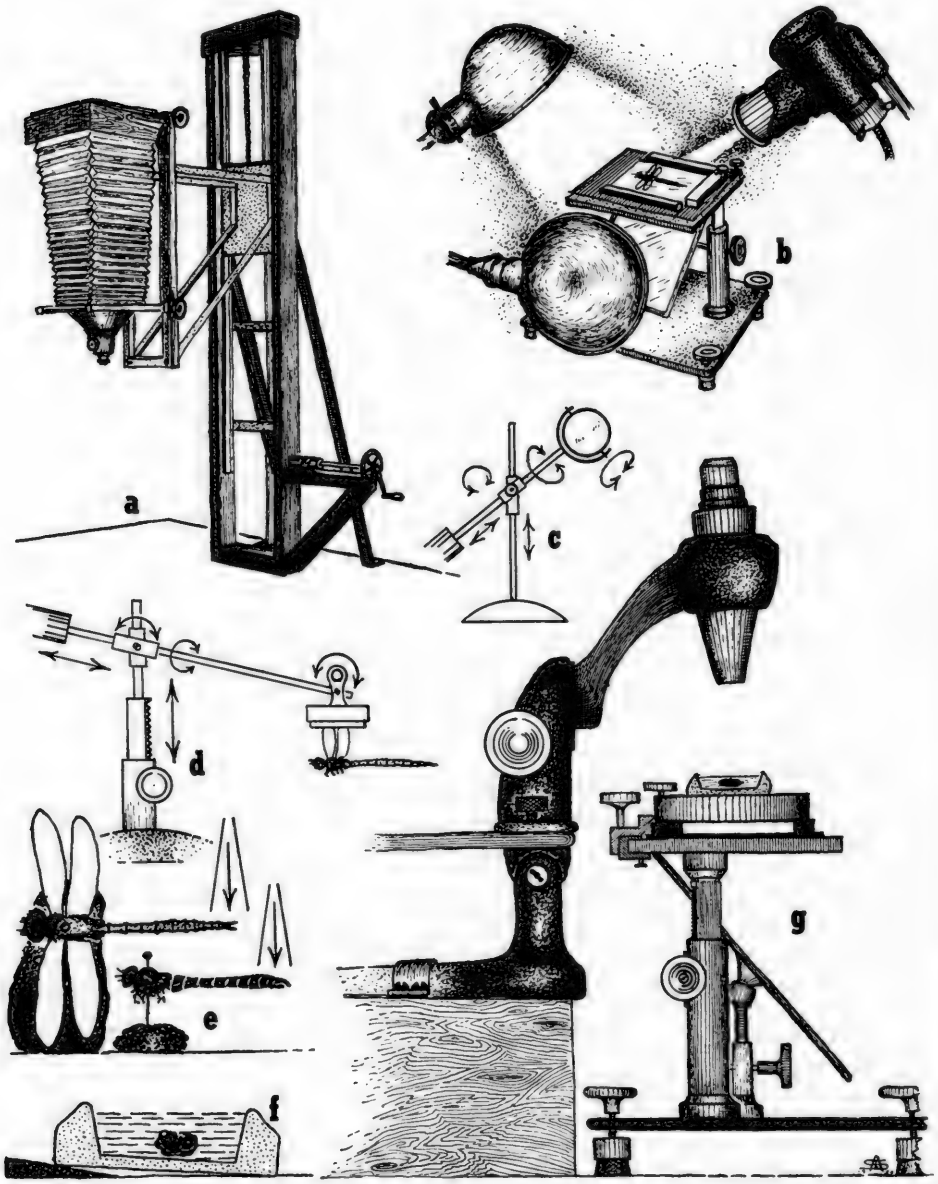

Figure 3. Apparatus utilized in photography of the dragonfly. (a) counterbalanced table camera, (b) adjustable low power stage, (c) flexible bull's eye lens for concentrating light, (d) specimen holding device for whole adults with un-spread wings, (e) use of clay lumps for positioning pinned and spread collection specimens, (f) the use of a simple wedge to secure a perfect camera perpendicular to immersed specimens and appendages, (g) method of axially positioning binocular over specimen on low power stage.

EQUIPMENT UTILIZED

Since the problem involved macrophotography instead of photomicrography, low power micro-tessar type objectives alone were used. To provide for critical focussing the lens was positioned in a focussing snout which attached to the lens board area of the camera. The snout also permits a wider angle of illumination, (Figure 2 F). Due to the nature of the specimens, and particularly to those photographed in immersion, a vertical camera unit, which could be suspended directly over the specimen, was essential. Figure 3 includes a view of the special camera stand employed for the project.[2] The counter-balanced camera unit could be raised to permit accurate placement of the specimen and lowered on an axial line to center directly over the object. A professional length bellows having a maximum draw of twenty-four inches provided a satisfactory range of adjustment.

The accurate positioning of those specimens which were immersed was a tedious and critical process. To assist in this task, a specially designed and constructed low power stage was used.[3] This stage, shown in figure 2 G, possessed several important movements. It could be raised or lowered; an adjustable mirror provided transillumination; a condenser unit or opal glass table was attached to a mechanical stage permitting lateral or longitudal movement. The specimen itself was held in a watchglass by devious means such as glass fragments, lead weights and plasticine. Specimens which were photographed dry were positioned directly on, or suspended over, the large condensing lens of the low power stage. Where necessary, props were employed to aid in positioning.

Inasmuch as the final critical positioning and alignment of the specimen could not be easily accomplished by eye, a low power binocular was adapted to swing into the scene in such a manner that it also was axially centered with the camera. This required the removal of one of the main attachments screws of the binocular post to its stage. The binocular stage and horseshoe base could not be accommodated in the area of the subject stage, so in use it was strapped to a supporting block and the binocular itself with its single screw pivot adjustment could be swung into position. This scheme is shown in figure 3.

The illumination of specimens, and particularly those involving reflectant half tones, required a means of providing intense light within the small area included. As in the case of modeled illumination for conventional photography, a main source of light was augmented by less brilliant secondary sources. It is unfortunate that most miniature spotlights do not possess sufficient actinic brilliance to be useful for macrophotography. Lamps which are of sufficient brilliance are usually too large in physical size and too broad in coverage to be suitable. In the present instance, a small Leitz spotlamp was located which produced

an extremely brilliant and diffuse spot. As a rough but graphic example of its brightness, it would produce a brilliant spot in the center of an area illuminated by four number one photofloods in reflectors at a twelve inch distance. The condensing lens for this spotlight had one rough crackled surface which aided diffusion greatly, but not to the extent of affecting light concentration.

Another effective means of light concentration is the use of a bulls-eye condenser which can gather light from a relatively large source and bring it to a brilliant spot. A lens of this type mounted on an adjustable arm can be manipulated to advantage in establishing key lighting.

To achieve the best photographic results, many methods and materials were considered and several used. The dragonfly wings, being essentially silhouettes, suggested the use of a process panchromatic film, with the exceptions later noted. Panatomic X film was used for half tone work. Two film developers were employed, DK-50 and D-11, both being Eastman formulas. Although a normal half tone film would be processed in DK-50 and contrast film in D-11, these two developers were actually used according to the nature of the specimen. In this way a "flat toned" specimen might be recorded on half tone film and processed in a contrast developer to secure some additional "snap." A very flat specimen might be recorded on a contract film and developed in a half tone developer, thus providing much added "snap" without extending the contrast to extremes excluding half tones. Since the choice of processing method was dependent on individual specimens, there was no rule other than opinion regarding this choice. As a matter of record, the majority of films were processed normally.

DETAILS OF PHOTOGRAPHY

Wings: The photography of wings followed a basically simple procedure. Using the previously mentioned low power stage and wide field condenser, a section of opal glass was fitted into the mechanical stage as a platform and illumination was provided by the simple expedient of two gooseneck lamps containing number one photofloods. The light was directed by means of the large substage mirror to transilluminate the specimen, added diffusion being gained by the opal glass. A 100mm or 64mm (dependent on wing size) was utilized in a focussing mount and diaphragmed to the equivalent of f/11. A 5 x 7 inch film size was selected and this accommodated both front and rear wings, these being positioned between double glass slides. In all species except those having color patterns, contrast film was employed. Figure 4.

It was found that in a majority of the wing negatives areas existed in which the lines of venation tended to weaken and be of dubious strength for surviving the engraving process. To compensate for this situation, the subsequent prints

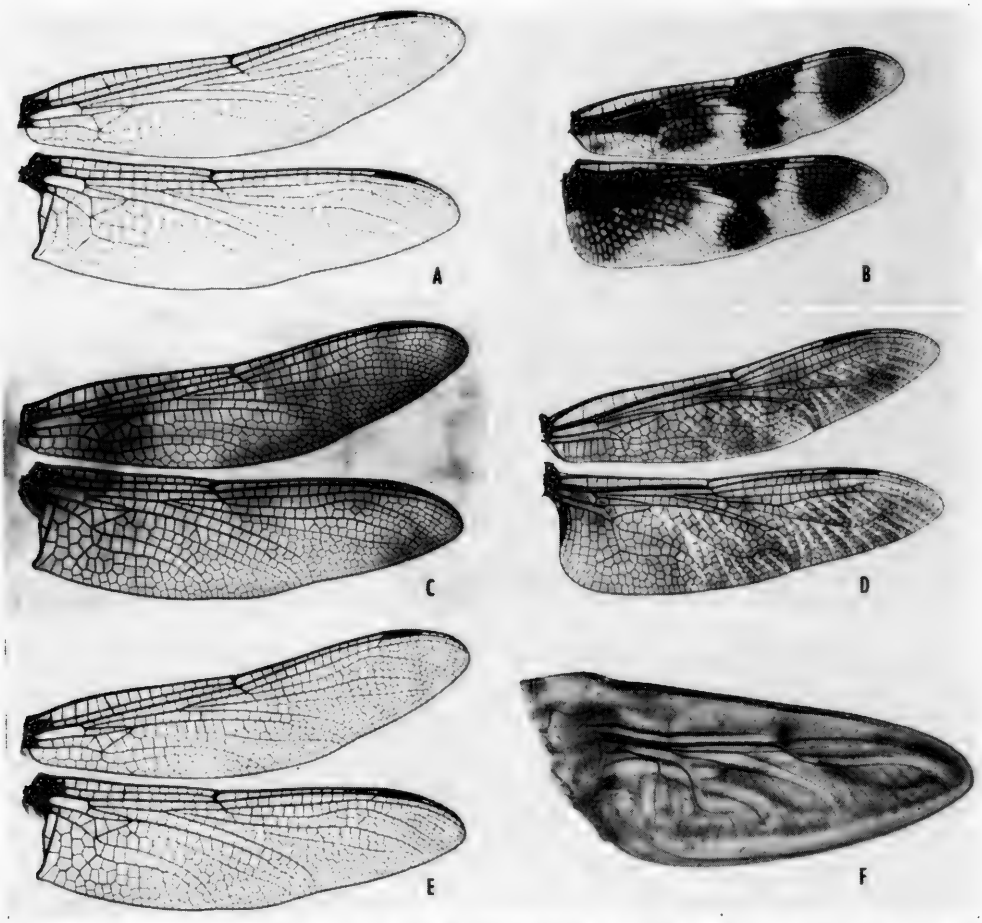

Figure 4. Dragonfly wings (A) Routine photograph of wing in which lower lines of fine venation are "weak," (C) Overexposed print of same negative as in A; (E) Same print as B, selectively bleached; (B) Wing which demonstrates important coloration and must be reproduced as half tone; (D) Wing fluting shown by use of low angle spotlight; (F) Immature wing showing tracheation.

were overexposed on bromide paper. This caused a spreading or thickening of the veins, and often considerable greyness in the background. To eliminate the grey and return originally strong lines to their normal thickness, a potassium ferricyanide bleach was employed. This bleach was brushed on selectively where needed and then a mild bath used over the entire print to remove the grey. Prior to the use of the bleach, the fixed print was left in hypo and was brought back to this solution following the corrective treatment.

In the event that photographically minded workers may question the reason for the appearance on the print of a grey overlay when using contrast type film,

it should perhaps be mentioned that over-exposure of the negative caused fine lines to fill in and become virtually unprintable. Consequently all negatives were exposed and developed to a minimum useable density. The inclusive process eventually resulted in accurate photographs of sufficient quality to reproduce well as zinc engravings. Although the description of this process may suggest that the method is difficult and time consuming, this was not so. Upon establishing the proper procedure, subsequent photographs were produced at the average rate of eight to ten negatives per hour and the total time per finished print approximately fifteen minutes each. Material costs averaged twenty cents per unit and if labor were valued at two dollars per hour, each pair of wings were illustrated for approximately seventy cents. Costs are mentioned in this instance only as a means of comparing the inexpensive and accurate photographs with the alternative of tedious hand delineations.

Nymphs: Dragonfly nymphs were, for the most part, photographed while immersed. Since most of these specimens had been preserved in alcohol shrinkage of the inner body from the skin created a somewhat unnatural appearance to some peripheral areas. Although the final prints were corrected by art methods, the initial problem was to obtain a normal illumination of both the outline and the dorsal details. A large variation in appearance was encountered and while some species possessed good tone separations, others were grey and lacking in contrast.

Nymphs are shown on front cover. (A) Cast skin photographed when nymph was not available. (B) Alcohol preserved specimen showing internal shrinking in peripheral areas. (C) Poorly preserved specimen lacking contrast—better reproduced by art methods. (D) Print (B) corrected with spotting colors.

Diffuse substage transillumination was used to obtain a white shadowless background. Since, as mentioned, part of the body was shrunken within the skin (see Cover, B) the semi-transparent periphery of body segments tended to transmit an excess of illumination. To compensate for this, the main key spotlight was carefully positioned to concentrate on the darker (thicker) areas. It was found that if the spot was directed in at an angle from the head end, a slight cast shadow from the wings tended to provide a tone separation from the body segments.

In addition to the key spotlight, a generally diffuse floodlight prevented any deep shadows which might have obscured details.

Greyish specimens which lacked good contrast or markings were difficult to record and in some instances the only choice was to rely on subsequent art work to provide certain tone separations.

Abdominal Appendages: The most difficult photographic problem involved

the male and female appendages. These areas were magnified to include the appendages themselves and the ninth and tenth abdominal segments. This of course also increased the problem of obtaining well modeled illumination due to the very small working area.

Three principal types of specimens were involved—dry specimens, "boiled" specimens, and those preserved in alcohol. Those which were dry tended to lose their natural coloration which normally provided a visual separation of segments in live forms. Highlights were also a problem. In an attempt to provide a better type of specimen for photography the last few segments of the body were dissected and placed in a weak solution of potassium hydroxide and occasionally heated until the muscles were dissolved enough to be removed—but not long enough to destroy pigmentation. The remaining exo-skeleton was photographed in alcohol. The principal disadvantage of this process was the translucency which permitted the entire depth of structural detail to be seen and thus created some confusion concerning surfaces and internal areas. Specimens preserved in alcohol displayed the best over-all characteristics for the purposes of photography. The appearance of each of the three specimen types described are shown in figure 5 A-F.

Where the availability of an expendable specimen permitted, the lateral view of the appendages was improved by the removal of one superior. This was done following the photography of the dorsal perspective.

Whereas a 100mm or 64mm lens was used for wings and a 64mm lens for most nymphs, a 42mm objective (and a long bellows) was required for the appendages in order to fill the area of a 3¼ x 4¼ sheet film. For hamules a 20mm objective was necessary, figure 6. The working distance was thus narrowed, making manipulation more difficult. Depth of field was very critical, as was related focussing and the best open diaphragm focus was often determined by trial. The illumination of a quarter inch area to a brilliance sufficient to allow for ground glass focussing became increasingly difficult with a fifteen inch bellows and a lens diaphragmed to an aperature suitable to observe depth of field. Although experiments showed that a 35mm film area offered better vision for focussing, the film size itself and the resultant image was too small for any required opaquing, etching or retouching.

Transillumination was used to obtain the shadowless background and one or more "fill" lights augmented the key light.

The placement of specimens to obtain near-perfect dorsal and lateral views created a problem. Figure 4 includes sketches which demonstrate graphically the simple yet effective means devised to hold specimens and make minor adjustments.

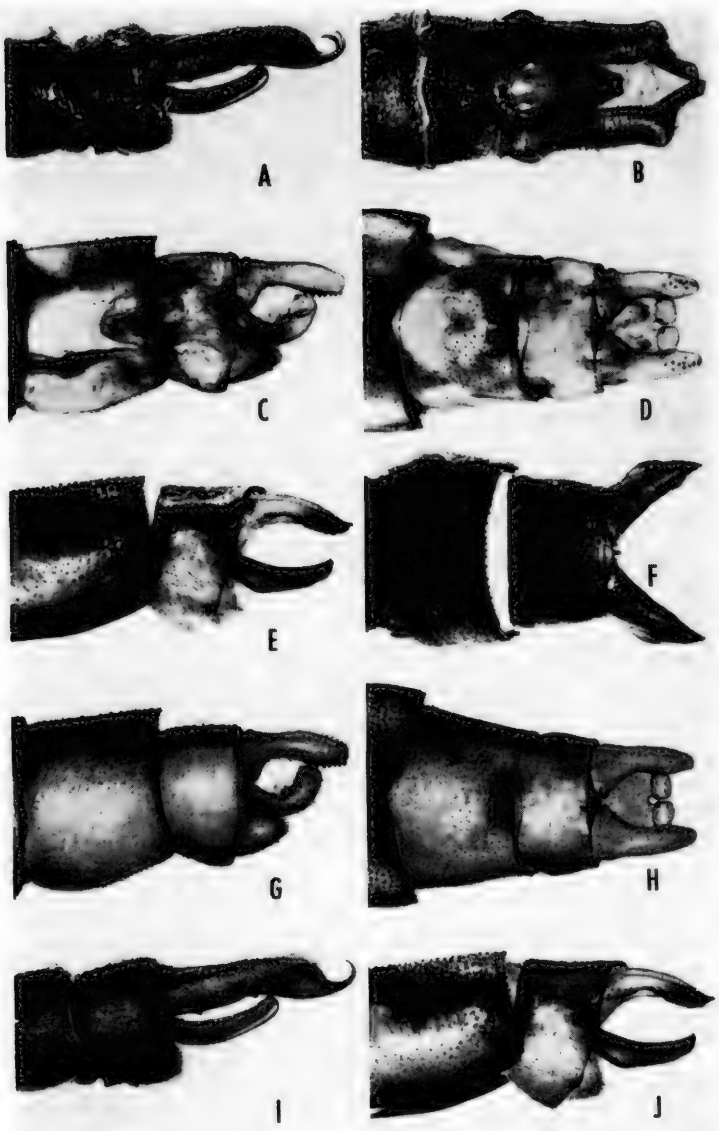

Figure 5. Appendages. (A) (B) Lateral and dorsal views of dry specimens; (C-D) "Boiled" specimens; (E-F) Alcohol preserved specimens; (G-H) Heavily retouched prints of specimens C and D; (I) Moderately retouched print of A; (J) Lightly retouched print of E.

CORRECTIVE TREATMENTS

In addition to the corrective methods described for wings, many of the other areas also required treatment to compensate for photographic losses, limitations, or for defective specimens. With regard to the latter, most specimens were

deteriorated to various extents, due to normal means of preservation. Several were extremely rare and specimens in good condition were just not available. Photographic losses, on the other hand, were largely due to lighting problems, optical limitations and the sensitized emulsions. Contrary to a common impression, photography does not imply an accuracy of form or tone. Admittedly, most photographs approach this extent to a far greater degree than other methods of illustration, but when extremely critical standards are involved, it may be necessary to utilize further accessory devices to approach the accuracy of the original. Such additions and manipulations to photographs may thus depend on the individual worker before they can be classed as either corrective or distortive. In the hands of an individual who desires only to compensate for the limitations of the photographic process, a final near-perfection can often be reached. The demands of scientific accuracy in the illustration of taxonomy are such that only normal corrective treatments are tolerable.

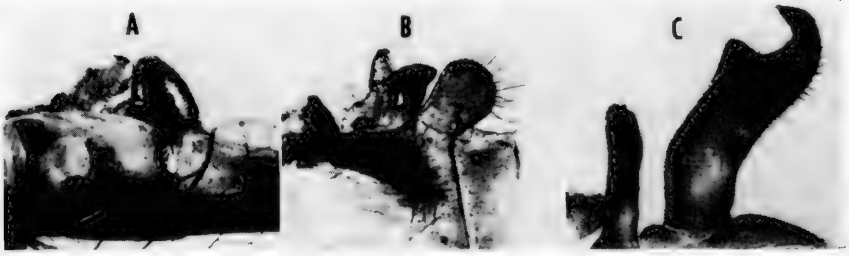

Figure 6. Hamules. (A) Undissected; (B) "Boiled", (C) Alcohol preserved—retouched print.

On the other hand, the sole purpose of the present illustrations was to present a visual means of identification. Irrespective of the means, or combination of means, accuracy was defined as the delineation of form and tones in such manner that segments were separable, modeling was characteristic and outline was normal. It will be shown that very often this end result required corrective treatment on both the negative and print, as well as subsequent art work. No attempt was made to secure an "unretouched photograph" per se, since such would have been misleading, if not inaccurate. It may be appreciated that the photographic process provides an inexpensive and critical outline of form and tone, despite problems in tone separation and specimen defects. Certainly this step alone provided a greater fundamental accuracy than ink sketches or wash drawings. Then, by using the flexibility of retouching colors where needed on the photographic prints, the advantages of the artist are added to the process, insuring the best final combination of detail outline and tone.

Those individuals who are familiar with the basic sensitometry of emulsions will appreciate that specimens with delicate tone differences in near-whites and

near-blacks are difficult to record. It is in these regions that greatest tone distortions occur. Initial compensation may be made in the form of the quality of the illumination employed. Secondary treatment may be provided in printing by the choice of sensitized paper, selective "dodging", and temperature control. The latter instance refers to the use of localized wet brush treatments during development. Warm water will accelerate development and cold water will retard it. The extent of such treatment is limited to the point where it is effective without causing a noticeable localized demarkation. Obviously this is a critical operation and may require several attempts before a fully satisfactory print is obtained.

The use of various art methods aided the appearance of many of the final prints. Spotting (retouch) colors were employed to re-form segments of specimens which were crushed, broken or distorted. In cases where fine line peripheral hairs did not photograph well, these were strengthened. Certain specimens were of such thickness that they exceeded the depth of field possible with available objectives. Careful retouching of the prints with matching tones sharpened details which were blurred from lack of focus. Figure 5 and the cover include several examples of how art was utilized for corrective purposes.

It should be re-emphasized that all chemical, optical or artistic means of correction must conscientiously follow the appearance of a typical specimen. Were it not for distortions within the recording process itself and for the quality of preserved specimens, very few modifications would be required.

REPRODUCTION OF PHOTOGRAPHS

The reproduction of half tone photographs produces further distortions since the image must be broken into a pattern of dots. A characteristic of half tone engraving is the clouding of whites to a moderate light grey and a slight tendency toward flatness. To accommodate these inevitable losses, the original photographs may be somewhat above normal contrast and should possess the best possible separation of tone differences.

The extensive use of engravings in a text adds considerably to its cost. Copper halftone or zinc line cuts are generally priced on a basis of area and consequently it is important that they be as small as possible and still retain necessary detail. Standard procedure in preparing photographic plates for reproduction is to anticipate reduction and to make originals about two to three times their text-printed size. If the amount of reduction is standardized throughout a series of figures, this aids the engraver and permits block handling. This procedure was followed in the preparation of all the dragonfly wings, nymphs and appendages.

CONCLUSIONS

To a certain extent the selection of photographic methods to illustrate a work in insect taxonomy has broken away from the more customary use of ink, stipple and wash drawings. It is felt that in using fundamental photographic recording and limited corrective treatments a gain in realism has been accomplished.

Although no specific attempt is made to claim originality, few references have been found or illustrations observed which indicate the use of photography for recording appendages or nymphs. Halftone wing photographs of varying quality have been occasionally used in publication and Hess[4], in 1940, described a method of projecting wing silhouettes on process film. To a large extent, therefore, it would appear that the several hundred photographs produced in the present project must constitute the most extensive use of photography as the principal method of illustration in the descriptive literature of the dragonfly.

There is no doubt but if the present dragonfly project could be redone on a basis of the initial experience gained that many improvements could be made. Despite this fact, however, the photographs obtained gave evidence of economy and quality.

The equipment utilized, or reasonable facsimiles, may be found in many institutional laboratories. There also appears to be a steady increase of photographic workers who are interested and competent in insect photography or the specific field of macrophotography. This may constitute a trend which will provide an opportunity for extended use of photographic methods and permit a reevaluation of certain phases of scientific illustration.

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Journal Award—Best Paper Volume 18

Control of Highlights in the Photography of Gross Specimens
by John J. Beiter,, Milton G. Bohrod and Harold A. Thomas

The February issue of our Journal stated that a prize would be awarded to the best paper in volume 18. A Committee consisting of Dr. Harry A. Charipper, Mr. J. W. Crunelle and Dr. John Fallon, representing Biology, Biological Photography and Medicine gave first choice to the Beiter-Bohrod-Thomas paper. A special Award Certificate will be sent to them.

An award will be given to the best paper in volume 19 of the Journal.

A Photographic Method for the Biological Analysis of Radiation Dosage

ZANE H. PRICE *

THE examination of corn seedlings grown from seed exposed to gamma radiation disclosed the fact that the first, second, third, and fourth leaves of the seedlings were mottled. This mottling assumed no definite pattern but the degree varied with the extent of radiation that was received by the seed. The effect was rather constant for a given exposure; and it became apparent that here might be the basis of a biological assay of radiation dosage by using leaves of known dosage to calibrate leaves of unknown dosage.

Such mottling is readily apparent to the casual observer and appears to be a less dense area in the chlorophyll; however its cytological cause has not yet been determined.

Since the mottling disappears as the leaves grow older, it is impossible to use them as a standard; unless they can be preserved either naturally or photographically. At first thought it seemed to be a simple problem but after an expenditure of much time and trouble it was found to be entirely opposite.

At this writing, actual preservation of the leaves has not proved successful due to the difficulty of preventing the decomposition of the chlorophyll. As this fades out, the mottling disappears to a great extent. However, further work is being done, and the new techniques of plastic preservation may be successful.

The photographic method proved to be the most useful, at least for the time being, and the balance of this paper covers that particular phase of the project.

The Photographic Technique

In order to prepare the standard, a group of seeds, checked to insure against genetic effects that might interfere with final dosage interpretation, was exposed to a controlled quantity of gamma radiation. The dosage, beginning with 5,000 r units, then in steps of 10,000 r, 15,000 r, 20,000 r, 30,000 r, 40,000 r, up to and including 50,000 r units. The seeds so exposed were then grown in the greenhouse, and from the ensuing seedlings a group of representative plants were picked for photography.

A series of pictures was made for each of the first, second, third, and fourth leaves in both black and white and color, using the following procedure:

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Received for publication September 15, 1950.

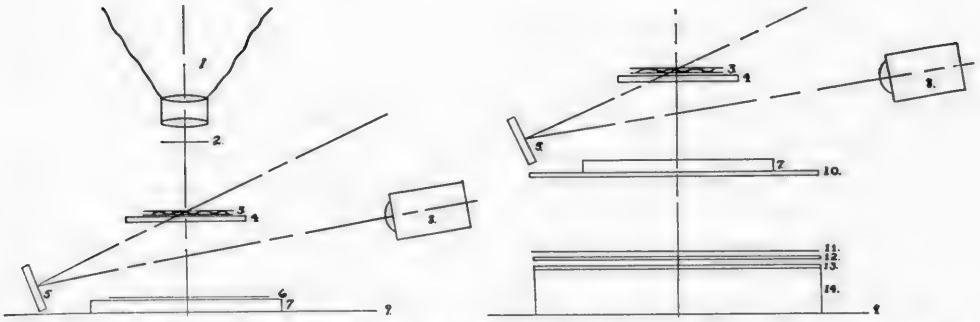

Figure 1. Left. Arrangement for black and white photographs. 1 camera, 2 red filter, 3 specimen, 4 stage, 5 mirror, 6 black paper, 7 macro-stage, 8 spot light and 9 table. Right. Arrangement for color photographs. 10 plate glass, 11 black paper, 12 red gelatin, 13 opal glass and 14 light box.

A five and one-half inch lens is used with a bellows-draw long enough to give a two and one-half inch magnification on four by five inch film. The camera is attached to a vertical photomicrographic machine, and a focusing macro-stage with an oversize mirror on a swinging arm is substituted for the microscope. Oblique transmitted illumination can thus be obtained by use of the mirror. A 500 watt spotlight, with Fresnel lens, serves as the light source.

The leaf to be photographed is placed between two, 2 x 2 inch glass cover slips held together by rubber bands and placed upon the stage. Care must be exercised to insure against crushing the leaf. The mirror is swung to one side to give the necessary oblique, transmitted illumination and the lamp, placed some fifteen inches to one side, is directed upon it. A piece of black matte cardboard is placed over the foot of the stage to give a black background, and thus provide contrast for the specimen.

The lamp and mirror are now adjusted to give even illumination over the entire leaf section. At the same time, the angle of light, from mirror to specimen, should be such that the beam of illumination does not strike the lens (Fig. 1). These angles are best adjusted while watching the ground glass of the camera.

An A-2 Wratten filter is placed over the lens to increase contrast. Exposure is determined with an ordinary exposure meter held close to the specimen, and the resultant reading is then adjusted for bellows length. The photograph is made on Ansco Super-Pan Press film.

In order to increase contrast, the latent image was over-developed about three minutes in DK-50. The negative was printed by enlargement in the usual manner.

The color exposures were made on four by five inch Ektachrome and developed in our own laboratories. Exposure was determined in the same manner as for the black and white.

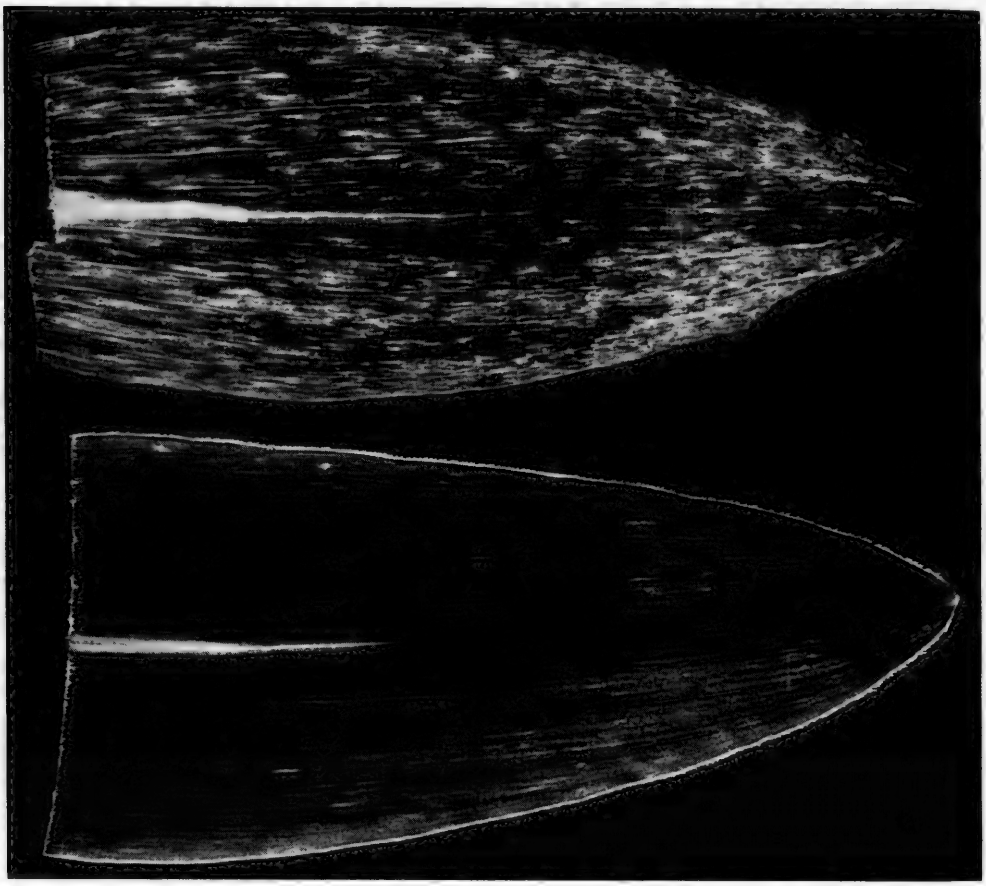

Figure 2. Lower leaf exposed to 5000 r units. Upper leaf exposed to 50,000 r units of gamma radiation.

In order to govern the contrast between leaf and background in the transparencies, a system of transillumination employing a filter of a complimentary color to the leaf, is used; in this instance, red, (Fig. 2). This consists of a box containing ordinary 10 watt lamp bulbs over which is held a sheet of opal glass and a large filter made from a piece of theatrical gelatin. A sheet of plate glass is in turn held about six inches above the filter. The macro-stage is placed upon this and the lighting arranged as before (Fig. 2). The Kelvin temperature is controlled by varying the voltage to the lamps with an auto-transformer.

The photograph is made in two steps. For the first exposure, the background lights are turned off and a large piece of black matte paper laid over the gelatin filter. This gives only the exposure for the leaf. In the second exposure, the lights are turned off on the leaf and turned on in the background. The black

paper is removed and the required exposure determined with the meter. It will probably be somewhat greater than was necessary for the leaf and the shutter will have to be adjusted accordingly. This double exposure procedure allows perfect control of the background color. It can be made lighter or darker by means of under or over exposure.

Upon examination of the prints and transparencies it was found that the second leaf in the medium of the transparency showed the mottling to best advantage.

Conclusion

The technique herein presented has given satisfactory results; although a few limitations must be considered. Interpretation of the dosage is based upon detail in the finished picture, and it is therefore of vital importance to the ultimate result. All camera manipulations must be carried out with this in mind. Focus, depth-of-field, contrast, lighting, and vibration must be carefully controlled. In order to reduce glare, the light beam, as it is directed obliquely onto the subject, must not be allowed to strike the camera lens. Care should also be exercised in mounting the leaf section to prevent its being crushed.

Another limitation to be considered is the selection of seed from which the plants are to be grown. Its genetic history should be checked to see that it contains no defects which would interfere with the dosage interpretation.

Since natural color is brought out in the Ektachrome transparencies, and are viewed by transmitted light, they most nearly equal the actual leaf, and for this reason show up to best advantage. The disadvantage of the prints lies in the fact that they must be viewed by reflected light and thus lose some detail. Because of this, black and white transparencies would show up pertinent information better than prints.

Perhaps the most important limitation to this method is in the interpretation of results. It was found somewhat difficult to distinguish between the 5,000 r and 10,000 r unit, and between the 15,000 r and 20,000 r unit pictures, at first glance, but differences between the other dosages were readily apparent.

However, this difficulty can be corrected to a great extent by the careful selection of plants to be used in making the standard. Since the assay is based on plants; and some variation is to be expected within individuals, those picked for photography should give the most representative mottling for the various dosages.

With a little training on the part of the interpreter and the foregoing points observed, no undue difficulty should be encountered in assaying unknown dosage from this standard.

Summary

A series of leaves from plants grown from seeds exposed to known gamma radiation of 5,000 r, 10,000 r, 15,000 r, 20,000 r 30,000 r, 40,000 r, and 50,000 r units, and displaying the characteristic proportional mottling were photographed, by oblique transmitted light, in both black and white and color as a means of preserving permanently a known standard. The unknown sample is then photographed in the same manner and the resulting picture is compared visually with the standard to determine its dosage to within 5,000 r units. The color transparency was found to give the best results since it most nearly resembled the actual leaf and is viewed in the same manner, viz., transmitted light. For optimum accuracy, some training is necessary for the person making the comparison.

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Your Association Needs Your Help

Last year our Association had a considerable deficit which was met by the use of some of the small reserve that had been accumulated before the war. Increasing costs of publishing the Journal and the costs of moving the offices of the Editor and Secretary largely accounted for the deficit. No Officer of the Association gets any of the Association money as salary or honorarium — only the actual cost, or part of the cost of maintaining the office is appropriated. Expenses are continuing to rise. We would not like to increase the dues, and with your help, we can continue without increasing dues. A Finance Committee headed by Dr. E. J. Farris, is exploring all possibilities for added income.

There are two ways you can aid your Association in this critical period. First, get some new members! The mainstay of our Association is our Journal, into which goes most of our money. The main cost of the Journal is getting it set in type and onto the printing press. The cost of printing a few hundred more copies would not be great, so that the income from that many more members would get us out of the red ink column. Is there not at least one photographer, or doctor, on your hospital staff, or in your community, you can get to join?

The second way to help is to become a Contributing Member by sending our Treasurer any contribution more than your dues. Contributing members are listed in the Journal. Contributions are deductible on Federal Income Tax returns.

This is a serious matter in the Association, and we know that you will do whatever is possible within your means to help the Association in solving this very important problem.

Association News

Our Secretary, Lloyd Varden, has been appointed Lecturer in Engineering at Columbia University and will give a course in *Photographic Technology* for them this fall.

R. J. Ross gave a paper entitled *"Duplication of color images with narrow band filters* at the New York City meeting of the Society of Motion Picture and Television Engineers.

A symposium on Modern Methods for Microscopy is to be arranged for the December meeting of the American Microscopical Society by Oscar W. Richards.

Your Association has a committee on the problems of training and certification. If you have any comments, questions, or material please send them to C. Graham Eddy, Chairman.

There has been a question raised about award certificates for print and motion picture awards at the annual meeting. The BPA Board has voted that one certificate only will be issued in the name or names of the individuals entering the motion picture or print in the competition. The members receiving a certificate may photoduplicate it, when the several persons entering the item wishes personal copies. Therefore, when it is desirable that the doctor with whom you work receive a copy of the certificate, you must enter it in both names. Then both names will appear on the certificate and you may make a copy for him.

What are you doing? Send interesting items for Association News to our able secretary Lloyd Varden.

Chapter News

By vote of the Board of Directors of the Biological Photographic Association charters were granted under the recent constitutional amendment to the following chapters: Boston, Chicago, New York, Northern Ohio, Rochester, Southern

California and West Virginia. The Rochester Chapter is newly formed and gives promise of success. We hear that the Pittsburgh Chapter is reviving.

New York. On April 25th Lloyd E. Varden spoke on "Problems in Accurate Color Reproduction" and on May 23rd Major Wilbur C. Lown is scheduled to talk on "Medical Photography and Photographic Research."

Northern Ohio. The March and April meetings were concerned with problems of certification and with cost and prices of photographic services. Under the former, the following topics were discussed: What gain from certification, who should sponsor it, should it be a professional society certificate or a state license, should there be a national registry with a code of ethics, what grades should be recognized (apprentice, junior, senior), and how to test for certification. The chapter appointed Messrs. Krumhansle, Fay and Stevenson to formulate a program for the chapter. The other topic was what is a fair price for a photograph? One opinion was that the cost of materials should be no less than 18% of the finished product. It was suggested that hourly rates should be from $2 to $4. Depreciation quantity and personal discounts were discussed. (A summary of this program would be desirable for publication in our Journal. — Editor.) For the May meeting Mr. Shields will show the Army Film "Medical Aspects of Atomic Warfare."

Southern California. For the April meeting the Navy Film "Lucite Calvarium" was shown and Frank Wilbar discussed "Basic Color Theory." On May 17th the chapter will visit the Drewry Photocolor Corporation.

Book Review

***Progress in Photography* 1940-1950. D. A. Spencer, Editor. Focal Press, London. 1951. 460 pp. $10.00. Order from Lloyd Varden, c/o Pavelle Color, Inc., 533 West 57th Street, New York 19.**

This is a truly international survey of ten years of progress. The Editor is a former President of the Royal Photographic Society, London, and the Board consists of W. F. Berg, London, J. Eggert, Zürich, L. E. Varden, New York and T. A. Vassy, Paris. The major sections cover: Photographic equipment and practice in America and Europe, Photographic process (sensitive materials, sensitometry, processing and supports), Recording documents, Recording dimensions (photogrammetry), Recording transient events (flash and speed), Recording sound, Recording color, Recording invisible radiation, Recording evidence, The camera as a tool of research (micrography to schlieren, including medical), The camera as an industrial tool, The camera as historian (National Archives, Library of Congress and problems of permanancy), The camera as teacher, Standardization and legal aspects, Business and scope of photography (America, France,

and Germany), Photographic Organizations, Appendix of periodicals referenced, and an index.

Most of the book is well balanced, although some sections are unfortunately nationalistic. Many of the sections are necessarily very brief. Most of them contain adequate literature citations to permit the reader to get into a given topical literature. Photomicrography provides four pages on the electron microscope and a scant two to the rest of the subject. None of the references cite more complete recent reviews, or the usual Journals in this field. Hansell covers medical photography in three pages and gives our Association due notice. Perhaps that is a fair allocation in a book of this size and does emphasize that in our field there is much opportunity for progress.

B.P.A. members are represented by Varden as coauthor of sensitive materials and new photo-sensitive systems (xerography, photosensitive glass, etc.) and Eddy on endoscopic photography. Photographers should study books like this to keep up on the rapid progress of the subject and for ideas from other fields that may be applied in their own problems. It should be assigned reading for any course in this subject. Despite the fact that a reviewer can find the sections he knows well too brief, the general coverage is remarkably complete and the editors deserve commendation for an excellent summary of progress in so wide a field as photography which contributes to most human activities. — O.W.R.

Announcement

The Photographers' Association of America will hold the first of its two Conventions and Trade Shows in New York City, at the Hotel Waldorf-Astoria, July 4th through July 8th.

The second Convention and Trade Show will be held in Milwaukee at the Milwaukee Auditorium, August 26th through August 29th.

Comprised primarily of studio photographers, many of whom are internationally famous, this Convention will offer visitors an impressive program of outstanding speakers, events and interesting picture exhibits, one of which by itself is expected to contain at least 2000 prints by P.A. of A. members.

In addition to a number of scheduled programs the Convention will also include a large exhibit of products of leading photographic manufacturers—with emphasis on the type of equipment and materials used by the professional photographer.

For all further information on the Convention, contact Mr. Harold E. Waltz, Executive Manager, Photographers' Association of America, 425 Jefferson Avenue, Toledo, Ohio.

REPORT OF THE NOMINATING COMMITTEE

The Nominating Committee proposes the following slate:

For: President — C. Graham Eddy
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Secretary — Lloyd E. Varden
Treasurer — Albert Levin

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Avis Gregersen, Chairman
Thomas J. Lannon
Chester F. Reather

No additional nominations were made by the Board of Directors at the May meeting of the Board. Members wishing to nominate additional names may do so by following the procedure provided in the Constitution. (See this Journal for 1948).

MEDICAL AND BIOLOGICAL ILLUSTRATION — July Issue

Preparation of Illustrations by Medical Authors	Eleanor A. Sweezy
The Use of Polarized Infra-Red Illumination in the Photography of Fossils	John E. Harris and E. Latham
Symposium on Cavity Illumination: Part 2	
1. Cavity Illumination Without Special Equipment	J. Kilshaw
2. The Use of a Concave Mirror for Cavity Illumination	F. Wardlaw
3. Parallel Beam Lighting for Small Cavities	E. Mackie and E. Gwynne-Evans
4. Photography of the Cervix Uteri	Brian Stamford
Medical Museums	Derek Martin
The Passage of the Hen's Egg Through the Oviduct	J. Fairfax Fozzard

Subscriptions ($7.00 per year) may be sent to Grune & Stratton, Inc., 381 Fourth Avenue, New York 16, N. Y.

Suggestions for Contributors

Manuscripts should be sent to The Editor, Journal of the Biological Photographic Association, 70 Alton Road, Stamford, Conn.

Manuscripts must be typewritten, double or triple spaced, with full margins. The original and not a carbon copy should be submitted.

References: References may be given as footnotes or, if numerous, may follow the context. They should be given in the following forms:

Book—Valasek, J. 1949. *Introduction to theoretical and experimental optics.* John Wiley & Sons, N. Y. x+454 pp.

Journal Article—Carman, P. D. 1949. Photogrammetric errors from Camera lens decentering. J. Opt. Soc. Am. 39(11):951-954.

Tables: Tables should be typed on separate pages and should have captions which will explain the data without reference to the text.

Illustrations: Wherever possible illustrations should conform to the following proportions:

Horizontal—the quotient of the height divided by the width should equal 0.7.

Vertical —the quotient of the width divided by the height should equal 0.7.

Full page illustrations should not be less than 6.7 inches by 9.5 inches. Others should not be less than 4.25 inches by 6 inches.

When mounted, illustrations should be twice or three times the page width which is 29 picas, or 4-5/6 inches. Illustrations for the cover should be multiple of 39 picas, or 6.5 inches.

Legends should be typed on a separate sheet and keyed for identification.

Editorial Policy: The Editor will endeavor to cooperate with the author by following suggestions regarding layout where it is feasible. The cost of publication may make it necessary to revise the text and group illustrations. The author will be advised of any extensive changes.

The Editor and the Editorial Board reserve the right to reject any material which proves to be too expensive and/or which they believe to be unsuitable for publication in the Journal.

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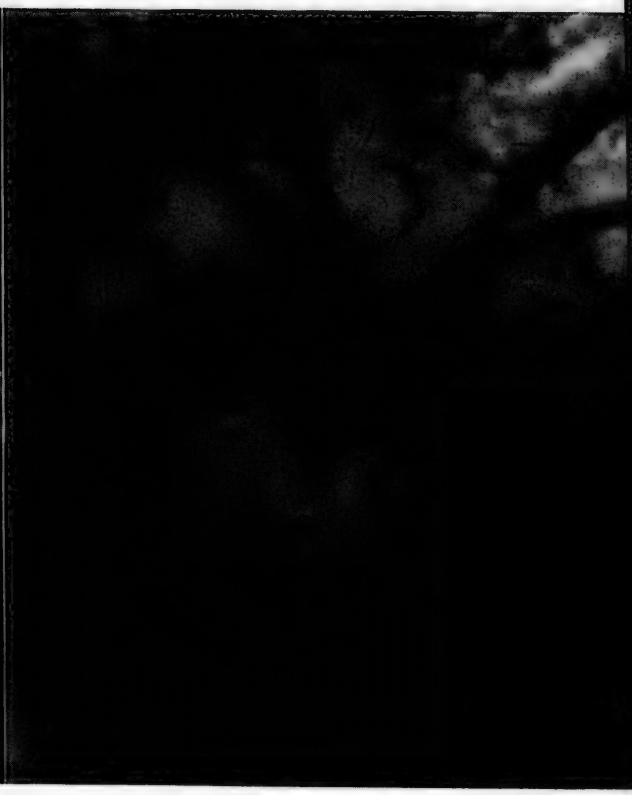

lus of Eye. 15 and 45X. (Page 128) *Margaret Markham*

August 1951

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SEE THE EAR HEAR
A Macroscopic-stroboscopic Cinematographic Study of the Ear

by

H. G. KOBRAK, M.D., Ph.D.*

FOR several years we have been engaged in research on the function of the ear. Since we were confronted with great methodical difficulties inherent to physiological acoustics, an analysis of the conventional methods was made. The conclusion was reached that biological photography had much to offer for further basic auditory research. Therefore extensive cinematographic recordings of the ear were undertaken. Two colored sound films, each of about 1200 feet length have been produced at the Otological Laboratories of the University of Chicago. "The Function of the Ear in Health and Disease" deals with the normal and diseased middle ear. The second film "The Inner Ear" describes some aspects of the morphology, physiology and pathology of the inner ear. Inasmuch as the analysis of the methods as well as the photographic technic is applicable to many problems in physiology, zoology, embryology, etc. it will be described here.

MACROSCOPIC CINEMATOGRAPHY VERSUS HISTOLOGICAL TISSUE EXAMINATION

A Comparison of Methods

The progress of our knowledge on hearing has been disappointing and painfully slow. For centuries, scientists have labored on the problem of audition. Unusual difficulties stand in the way. The three main obstacles are as follows:

1. The inaccessibility of the ear. The important structures of the ear are embedded deep inside the skull. Only the functionally insignificant parts of the outer ear are visible. 2. The smallness of the ear structures. The naked eye cannot distinguish morphological details. 3. The third fundamental difficulty lies in the nature of sound. Acoustic oscillations are rapid phenomena. The human eye cannot see repetitive movements of sound frequency because the fusion frequency of the visual sense organ is lower than the frequency of oscillations.

*University of Chicago, Department of Surgery, Chicago 37, Ill.
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When enumerating these difficulties it becomes clear why the students of the ear in the past mostly chose, or were forced to choose, the microscopic approach. The microscope solves the first two difficulties, at least to a certain extent. Histological sections make the remote inner ear accessible to the eye. Furthermore the lenses of the microscope enlarge the structures sufficiently so that most important morphologic details can be described. On the debit side of the microscopic technique stands the time consuming and expensive quality. More serious yet is the fact that artefacts due to histological technique are numerous. It is difficult or perhaps impossible to avoid artefacts completely. Their interpretation requires great experience.

And the worst of it all the microscope destroys what it examines. The animal has to be killed. The ear is removed from the skull and placed in fixation fluid. After a long process of fixation, dehydration, and embedding the object of examination is sectioned into a series of very thin slides. The multitude of stained sections on glass slides bears little resemblance to the original structure. Each slide is a cross section at a certain level. It is extremely difficult to obtain a three dimensional view of the whole organ from the two-dimensional sections. Occasionally it is important to reassemble the slides to a three dimensional image of the structure. Wax models can be made from each section. The wax slides are placed on top of each other until a three dimensional model of the original tissue is obtained which is indeed a cumbersome procedure. Biological photography when done skillfully can make this complicated, time consuming and expensive process unnecessary. It is possible to make photographic recordings without even touching the tissues. Using colored film, a good three dimensional effect is obtained.

Numerous cinematographic recordings of the middle ear or inner ear structures were made on living animals and on human cadavers soon after death. There is convincing experimental evidence available that the ligaments, membranes and articulations of the ear do not change immediately after death in regard to their physical behavior. Photographic recordings of acoustic vibrations in the fresh cadaver specimens show the same results as recordings obtained on living ears.

It was possible to observe the function of the ear during the process of hearing. The tissues were enlarged by low power magnification. (Fig. 1) The forced vibrations occurring in the ear during the act of hearing were photographed. The camera can photograph a multitude of simultaneous phenomena, shows no fatigue and permits re-visualization of a scene for additional detailed studies and for demonstration to others. The rapidity of the auditory oscillations has to be decelerated. The artificial deceleration is a decisive factor in visualizing

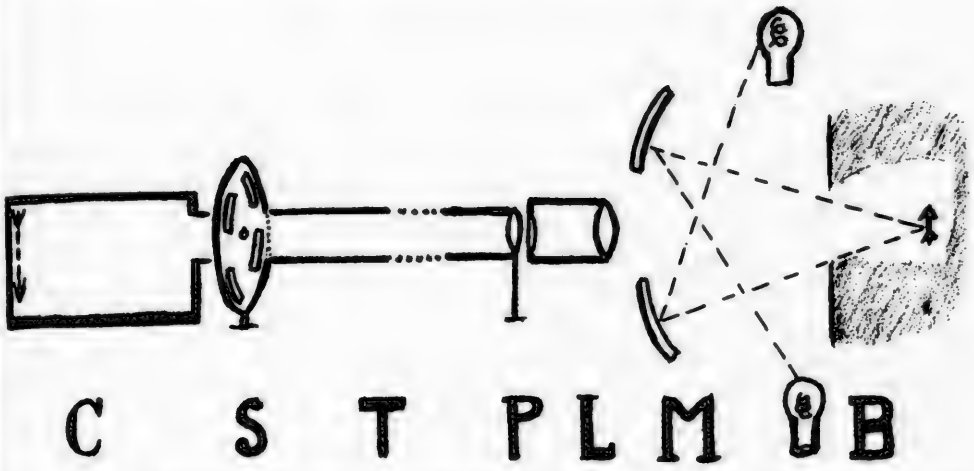

Figure 1. Macroscopic-stroboscopic Cinematography of a vibrating structure within a body cavity. Schematic arrangement of the photographic equipment.

The object to be photographed is a part of the middle ear or inner ear; (depicted as the small upright arrow on right side of picture). It is located within a cavity of the skull. To visualize it, a hole was drilled into the bone. Illumination of the cavity is accomplished by several light bulbs (B) the light of which is cooled and then condensed and reflected by the concave mirrors (M). Cooling equipment and polaroid screens are not shown. A large image of the target is obtained by extending the distance between lens (L) and camera (C) using extension tubes (T). The rapid vibrations of the object are optically decelerated by the rotating, perforated disk which acts as a stroboscope (S). Optional equipment is the polaroid filter P, which is occasionally used if excessive glare diminishes the visibility of details. Good depth of field is accomplished by selecting a proper lens opening.

A second magnification is obtained when the film is projected. The result is a slowly moving, easily discernible enlarged image on the screen.

and measuring the acoustic phenomena within the ear during the process of hearing. When the ear hears the tone middle C the eardrum and small bones in the middle ear will vibrate with the same frequency. Each vibration lasts only 1/256 of a second, but it can be made to appear to last much longer, for example, a whole second, or half a second, a tenth of a second, etc. This has been called—in analogy with optical magnification—the method of Time Microscopy. The motion picture camera possesses the facility of combining readily *optic* and *time magnification.* There are two principles by which the camera can be used as a Time Microscope. One is to make exposures at high film speeds. If in a high speed camera, 3000 frames are exposed per second, a playback at conventional 16 frame speed is a time magnification of nearly 200. Since most of the Inner Ear phenomena are repetitive, the older and much cheaper method of stroboscopic photography can be used.

The stroboscope is a device that permits vibrating bodies to be viewed intermittently. An optical effect of slowing down or even of stopping of the motion

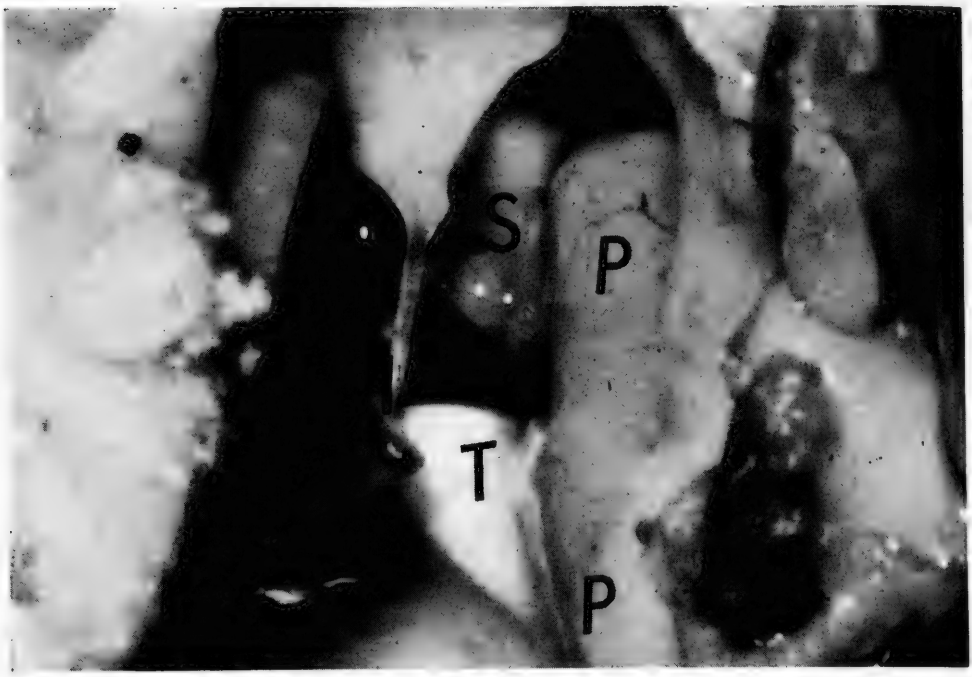

Figure 2. A sample shot obtained by the method described in Figure 1. The middle ear cavity of a living anesthetized rabbit. A part of the wall of the middle ear cavity was removed with a dental drill. This hole exposes all important middle ear structures (eardrum, E), the three ossicles, hammer (H), anvil (A) and stirrup (S), the tensor tympani muscle (T), the stapedius tendon, the promontory (P). None of these exposed structures is touched directly. The natural size of the middle ear structures of the rabbit is so small that most of them are not visible to the unaided eye.

To examine the structure by conventional microscopic technique it would be necessary to kill the animal, dissect the ear out of the skull, and place the specimen in fixation fluid. Completion of the microscopic work up would take several months.

The advantage of macroscopic stroboscopic cinematography lies in obtaining sufficient enlargement to see all important structures clearly. In addition, the function of the ear can be studied. The acoustic oscillations of the eardrum and ossicles and the reflex contractions of the two muscles can be recorded cinematographically with this method.

is thus achieved. The simplest form of stroboscope is a rotating perforated disc. The light, which serves for illumination, is interrupted intermittently by the disc. Whenever a hole passes through the light beam, a flash of light is emitted, while no illumination exists during the period of time during which the disc occludes the light source. Short flashes of light are thus produced. The number of flashes is controlled by the number of rotations of the disc and the number of holes in the disc. When the number of flashes coincides with the speed of vibration, the motion is apparently stopped. It must be kept in mind that the shutter mechanism of the movie camera also acts as a stroboscope. When using a revolving disc before the camera (as shown in Fig. 1), actually two strobo-

scopes are employed in the experiment. This realization is important because the stroboscopically decelerated scene observed in the finder may not be identical with the exposure on the film. The differences however are mostly insignificant. The tuning between stroboscope and frequency of vibrations can be accomplished by selecting the proper tone frequency or by changing the speed of the revolving stroboscope disc. A different principle of stroboscopic technique consists in a light source which flashes several times up to a hundred times or more per second. The interrupted light of the electronically controlled stroboscope is excellent for observation of fast repetitive phenomena; but it is rarely strong enough for photographic use.

The Photographic Set Up

None of the components of the photographic set up (Fig. 1) is new. However, by utilizing well known principles for a special problem, new and enlightening observations can be made. With this method it was possible for the first time to make cinematographic recordings of the ear in action. Detailed observations can be made as to how the parts of the ear execute forced vibrations in response to sound. One can SEE THE EAR HEAR. Certain diseased ears do not vibrate normally and it was possible to observe the abnormalities. The photographic recording is not meant to replace the histological examination. It is used to *amend* it. Every specimen can be subjected to microscopic tissue examination after the acoustic recordings. Figure 1 shows the photographic technique: A strong light source is of utmost importance because the stroboscope and the narrow lens opening diminish the light intensity greatly. Several light bulbs ($K = 3200$) were used. The light beam was cooled and condensed; concave mirrors were used for reflecting the beam into the cavity. The use of several light sources made it advisable to place the stroboscope into the "final common path" between lens and film. The lens, being far extended from the camera must have its own support to avoid shaking. Polaroid equipment (screens for the light source and a filter) is optional. Light points on the specimen were not considered disadvantageous; they enliven the scene occasionally and show small movements which would be invisible in specimen without light points. Glare from tissue surfaces is however to be avoided. Color rendition is only of academic interest in our work. The reason is obvious: The eardrum and parts of the middle ear are observed by otologists in their clinical work. It is customary to use artificial light for this purpose. Rendering a true color rendition by well balanced light will show the structure in a color to which experienced observers are not accustomed.

On the other hand the structures of the Inner Ear have almost always been studied by histological methods, i.e. on stained serial sections. With the exception of a few research workers, no one has ever seen the structures of the Inner Ear in their natural shape and color before. It cannot be expected, therefore, that the audience will appreciate a true color rendition.

The advantage of color photography over black and white lies in the better three-dimensional appearance of the structures.

The magnifications needed in the work on ear structures vary. An object to image ratio of 1 to 1, or 1 to 3, or even 1 to 4 was used. That means the image on the film was one to four times as large as the object. A second magnification is provided by the projection. The amount of total projection depends in addition to the object to image ratio on the lens of the projector and the placement of the observer in respect to the location of the projector. In our attempts to measure the amplitudes of vibrations we project the film on a white paper. The excursions are then marked with a pencil. If for example an amplitude of 1 cm. is observed on the screen and provided the overall linear magnification is 500 times, then the vibration in the ear has an amplitude of 20 micra.*

Time control can be accomplished by a High Speed Camera and by Stroboscope. For recording of repetitive phenomena we have used the stroboscope. In nearly every respect, the results of the stroboscope are as good as those obtained with a High-Speed Camera. However, speedy non-repetitive phenomena like an explosion have to be recorded with the Hi Speed Camera. We were able to record the destruction of the middle ear by an explosion under a time magnification of 200 to 1. Even with such great camera speed as 3000 frames per second, the phenomenon is recorded only on a few frames.

Summary

Modern biological photography permits detailed morphological studies on tissues which heretofore were only studied by conventional microscopy. The complex and confusing architecture of the Inner Ear is a typical example. Observations on the function of the tissues can be made, especially if time magnification is used in conjunction with optical magnification. It is evident that many problems of physiology can be studied with biological photography with the expectation that new and important findings be obtained by its application.

*For a more detailed description of quantitative usage of film recordings see H. G. Kobrak: "A new method of scientific investigation of the inner ear," The Laryngoscope 57:247-255 (April) 1947.

A Plan for a College Degree in Medical Photographic Technology

BERNARD H. MOLLBERG*

THE position or role of the medical photographer is one of considerable importance to the staff and directors of medical institutions today. Where will the photographer fit into the scheme of operations? What will be his duties? What will be his salvation?

To most medical photographers these questions are taken in stride and no attempt is made to answer them for fear of any number of reasons. Many think that the only need is the ability to take a picture under a given set of circumstances and the production of a reasonable facsimile of the net results desired. Many are worried about their inability to work side by side with doctors and understand their "lingo". But regardless of the many fears or lack of fears confronting him, the most important factor to the photographer as an individual is his concept of his role and his conviction as to his personal qualifications.

To the administrator, the pathologist, or the surgeon, there may be some question as to a man's qualifications requisite to his functioning as a medical photographer. Can the photographer do the job, they may ask, and if he can't, what are he and his fellow members lacking? And where does the photographer get his background and basic knowledge of medical photography or even general photographic theory? Who judges him as a medical photographer and by what standards and rules does he claim to be a medical photographer? These are questions confronting many disillusioned hospital administrators today. Is there no way to screen the influx of claimants who aspire to be medical photographic technicians? If a person wants to become a medical photographer, he should have the benefit of knowing that he is adjusted to the profession mentally and qualified in his knowledge and ability. Certainly, the administrator is entitled to an even break in reviewing applicants for positions as they are available.

A person need not be antagonistic, to look around and realize that the bulk of the medical photographers today did not get there through their special training in their field. Most of them learned it the same way physicians and dentists learned their profession a century ago—through apprenticeship. Apprenticeship procedure is highly personalized and frequently lacks organization. If apprentice

*Research Institute, University of Houston, Houston 4, Texas. Received for publication March 3, 1951.

patterns could be standardized and regulated, the problem would not be so great. There are far too many people in a number of trades or professions who neglect apprentice work but still expect in some vague way to become a master. Anyone who can sell a bill of goods can become a photographer, but as to how long he can maintain himself in that position is usually determined by his ability or inability to learn. Usually the unqualified lose out, but workers with initiative and superior understanding survive and eventually attain the positions for which they applied themselves.

The question of what happens to the photographer who lost the position may seem insignificant, and "good riddance" might be the comment made, but this is the photographer about whom we should be concerned. He is the problem and the person that we need to help. Certainly he is better out of the picture, but the question of why he failed and how much he retards the progress of other prospective medical photographers must be considered. He has caused, and justifiably so, a considerable amount of resistence to the installation of photography units in hospitals and schools of medicine. If a school were exposed to such a person, and if only the budgetary aspects were influenced, the administrator might reconsider if another seemingly more qualified person were to apply. But usually there are many other people involved, such as the surgeon who may have lost a lot of valuable visual aid material and photographic records. These are the people who are either pleased or displeased with a service, and, accordingly, they will either reject or request support of the medical photography department. Many such departments have either ceased to exist or, at best, change personnel frequently—much too frequently to produce consistent records.

Nothing is more discouraging than to see physicians buying their own equipment and producing their own photographs when the hospital maintains a photo lab and technicians for the specific purpose of satisfying their demands. Conditions such as these described do exist, and it is a pathetic example of what is happening to produce administrative and staff differences. It is not fair to resident physicians, and it cuts down on their research time when they have to make their own photographic records. Certainly it is not to the hospital's credit if the physician is not a good photographer and his work shows it.

Standards. The root of the trouble always seems to stem back to the photographer who does not make a favorable issue of his endeavors. The single failure tarnishes the reputation of a dozen potential medical photographers. The amplifications of a series of failures are usually enough to convince an institution that such ventures are more embarrassment than benefit. The time is coming for a determination of qualifications, and we should not hesitate to accept the need for standards. It is a form of insurance for the benefit of present and potential

medical photographers, and it is the only means of raising the standard of performance. Qualifying examinations are definitely needed to certify a person in the field of medical photographic technology.

Standards of certification should not be as easy as some that have been reviewed in the past. They should be rigid and should demand the respect of not only the applicant but also of people responsible for creating medical photographic departments. If the administrator is given some assurance that his venture will not lack for a technician, the progress of the venture will be gratifying. When responsibility can be delegated with assurance, success is a certainty.

If a qualifying examination is to be given, it will certainly be given to people who deem themselves as qualified. Their personal qualifications may come from many different sources, but, basically, it comes from instruction either as an apprentice or from an educational institution, preferably both. The physician does not qualify when he graduates from medical school but must wait until he serves his modified apprenticeship or internship. Learning how to do a job and actually doing it are two entirely different but interdependent things. Schooling is important in establishing the fundamentals of any field, but actual practice is where schooling is put to the acid test and deficiencies are treated. Proper schooling or training in the fundamentals of medical photographic technology is just as important to the photographer as medical school training is to the physician.

Such an approach should not be made without study, however, and certain merits should be considered. There are too many photographic schools which promise to train a person in medical photography without ever letting him see a preserved specimen—let alone a fresh specimen. Most of these schools fail to distinguish between periosteum and peritoneum, and most of the students believe that these terms surely apply to emulsion and antihalation backing, endosteum apparently falling in between! The medical photographer has to be a photographic technician first, last, and always. He also has to know his anatomy, physiology, histology and terminology if he is to demand respect and satisfaction of the physician. Correct anatomical positioning is extremely important in gross specimen photography, and it ill behooves the photographer if he frames the heart with the large intestine.

It is an established fact, both in theory and practice, that more harmony exists and greater cooperation is possible, if co-workers share the same background and have a common bond. This is not to imply that the medical photographer should have attended medical school, but it should imply that both the photographer and physician have studied the same basic sciences. The intensity of study need not be parallel, but at least there should be a plane of mutual understanding and common knowledge in order that a decent and con-

structive conversation can be carried on between the two parties. The simple fact that the photographer can *think* along the same lines that the physician thinks creates a sense of security on the part of both parties. Simple remembrances of trials and tribulations concerning undergraduate work in organic chemistry may sometimes ease a tense feeling over a problem.

A step to better qualify photographers for medical photographic technology would be one which is designed not only to teach and perfect photographic techniques, but also to foster that inherent feeling of belonging to a position through an improved knowledge of the entire subject, both photographic and biological. Bondage by ignorance is a chief contributing factor to an overburdance of inferiority in many cases. The field of medical photography is much too complex for a good photographic technician. It is necessary that the person be both a good photographic technician and a promising medical technologist.

Returning to the need for a governing device to qualify the medical photographer, not only for his sake but also for the safety and maintenance of higher standards of operation, it could be prognosed that the eventuality will stipulate proper training and justified qualifying examinations. If the conditions of such a prognosis should be carried out, a more operational and stronger association could be achieved. Such a program would undoubtedly appeal to organizations having a need for medical and biological photographic personnel. Institutions are inclined to be more receptive to applicants who have backgrounds steming from college training.

The trend towards specialization stimulates a competitive understanding on human nature's wants. This trend is comparable to the concept of the survival of species, implying more adaptability to a given environment. The survival of a person in a profession is comparatively the same. The photographic trade school is not the place to train a medical photographer. This fact is easily borne out by a survey of the misfits that have developed in positions. Credit should be given, however, to those successful photographers who were brought up by this method, and, truly, they are persons of superior ability. But their period of transition from photographic to medical photographic would have been more rapid and more smooth had they been trained for both at the same time. The author is acquainted with several of these individuals and nothing but praise can be given to them for the determination and stamina which eventually led them to success. Most will admit that the period of conversion was extremely difficult and quite often was threatened with defeat. To those who survived, both the problem and the treatment is easily understood. Some of these photographers employ our former students and admit the ease with which the students were able to hit the stride.

Dogmatism in this problem is not intended, but from the viewpoint of the institution a realistic approach to the problem is important. A degree from a University is a tangible measure of ability and attainment. It is respected among academic men and constantly serves as a criterion for evaluation.

College Program. If a plan can be formulated for training the student in medical photographic technology which will at the same time allow him to satisfy the degree requirements for a Bachelor of Science degree, a step has been made towards placing a man in a definite position for doing specialized service to others. This is the creed of universities throughout the world. Universities exist for the specific purpose of helping people to adjust their lives to better advancement and service. The satisfaction is doubly rewarding if several purposes can be accomplished, thus better qualifying the student. If the basic degree plan can be further adapted to satisfy not only photographic technology but also to instruct the student in basic science, the potential medical photographer is further assisted in understanding the related phases of the field.

For the degree of Bachelor of Science, a student devotes four years to academic work, including not only his major subject but also three other subjects which he studies as minors. The medical photographer, however, would pursue two major subjects, photography and biology. This would leave only two minors with which to deal. Actually, the student would have to choose between a major in Photography with a strong minor in Biology or a major in Biology with a strong minor in Photography. The university would have to be equipped and staffed to offer courses in photography or at least to be willing to sponsor the additional program.

The program in Table 1 is a suggested plan for students desiring to work on a major in biological or medical photography. It has been found to possess enough essential course material which would be necessary but still give the student enough elective courses to satisfy personal demands. It has been set up on a four year basis.

This program is designed to equip the potential medical photographer with a strong background in the two most essential fields—photography and biology. A proper understanding of photography is accepted as the primary reason for the course of study, but the role of a good biological schooling is equally essential.

A review of the program year by year, might serve to amplify the value of certain courses and make clear the order by which they are taken up in the four year plan. It must be remembered that the suggested program is intentionally designed to emphasize photography and biology. In so doing, perhaps a few equally essential phases may seem to be slighted or touched only lightly. If this is so, it is due to the fact that a four year program is discussed and does

TABLE 1. PROGRAM FOR DEGREE

Freshman Year

Biology 144: General Biology
Biology 146: Human Anatomy and Physiology
Chemistry 141-142: Introductory General Chemistry
Photography 141-142: Fundamentals of Photography
English 131-132: Composition and Western World Lit.
Mathematics 131: College Algebra
Mathematics 132: Plane Trigonometry

Sophomore Year

Biology 237-238: Medical Terminology
Chemistry 341-342: Fundamentals of Organic Chemistry
Photography 340: Biological Photography
Photography 440: Photomicrography
Photography 223-224: Retouching
English 233: Advanced Composition
English 236: Technical Report Writing

Junior Year

Biology 445: Histology
Biology 446: Histological Technique
Photography 341-342: Color Photography
Photography 443-444: Specialized Photography
Physics 141-142: Introductory General Physics

Senior Year

Government 233: American National Government
Government 234: American State and Local Government
Photography 400: Special Problems
Photography 349: Field Photography
Electives: (8 additional hours per semester or a total of 16 for the senior year)
Photography 343-344: Portrait Photography
Biology 243: Elementary Bacteriology
Biology 231: Public Health Bacteriology
Art 236-237: Figure Drawing
(Also: economics, history or psychology)

not suit individual needs. Such variations could very easily be made to include several courses such as art, economics, management. A Bachelor of Science degree is usually awarded for completing requirements for one major, three minors and several general course requirements. A total of at least 122 semester hours and possibly 160 semester hours are necessary to satisfy general degree

requirements. The suggested program totals up to 130 semester hours and is considered by the author as the minimum for the proposed degree. The major would be photography, and the three minors would be biology, chemistry and either mathematics, art or language. For the medical photographer who is likely to double as a medical illustrator, additional work in art would be advantageous.

Freshman Year: The fundamentals of photography, biology, and anatomy are incorporated in the first year as a means of laying down the basis of all future work. The fundamentals of photographic theory, technique and equipment are taught the first year so that future photography courses can proceed at a much more rapid pace, covering more technical and advanced procedures. The one year spent in this pursuit is well worth the effort on a long term basis. This is the general course required for all photography majors, whether their field in portraiture, color, medical or commercial. The course in General Biology is also a basic course in both anatomy and life processes. It is not entirely applicable to human aspects, but the bio-nomic value is extremely important. Rather than suggest the second semester in General Biology, which is devoted to botany, a course in Human Anatomy and Physiology is offered to emphasize anatomy of the human body. It is essential that the student knows structure and function of the human body to apply to future work in surgical and gross specimen photography. General degree requirements list the courses in English and are therefore best dispensed with in the first two years. Chemistry, which will be one of the minors, is best started in the first year to pave the way to the advanced chemistry course and to make for an easier understanding of photographic chemistry problems in the junior and senior years. Beginning Art courses could easily be substituted for the Mathematics courses for those wishing to double as medical illustrators, but a good background in math will never be regretted.

Sophomore Year: This is actually the first exposure the student will have to medical photography. Biological Photography is a course which is designed to introduce the student to the various phases of general scientific photography. It is not a course which is strictly medical in design, but it is basic, and the various techniques introduced are easily applied to problems encountered later. As a continuation of the course in Biological Photography, Photomicrography is offered as a course devoted strictly to problems encountered while photographing material through the microscope. This course involves all stages of magnification from low to oil immersion, darkfield, direct separation techniques and color. Usually forgotten and often times underemphasized, a course in retouching negatives is very essential for producing effective photographs. Medical Terminology is primarily a course for medical secretaries, but the information given is well designed for aiding the medical photographer to understand and

carry out work orders. The requirements for the minor in chemistry are completed during the sophomore year with the course in Organic Chemistry. This course is especially suited for photographers in that many of the photographic materials and developers are covered in minute detail. The two courses in English complete the requirements for a degree and at the same time give the student an understanding of proper report preparation.

Junior Year: During the third year, the student gets a thorough grounding in advanced work, both photographic and biological. A great amount of emphasis is placed on body organs, their micro-anatomy, and function and relation to the rest of the body. This course in Histology is then followed by Histological Technique in which the student learns to prepare tissue for microscopic study and staining techniques. The latter gives experience in the use of the various types of stains and pathological tissues. Worth noting at this point is the fact that a background in this phase of medical technology might qualify a medical photographer for a dual position in an institution as both photographic and medical technologist. Many hospitals cannot afford full time photographers but can find positions for persons possessing dual qualifications.

The two semesters of Color Photography give the student instruction in exposing and processing color films and making prints by the dye transfer process. Also included in this course are discussions and demonstrations in various color media in common use and new products as they are introduced. General Physics is taken during this year so that the student desiring to use physics as a minor will have sufficient time remaining to take other courses in the senior year. This course will allow the student to become acquainted with factors of general physics and also physical optics. From this the student will acquire an adequate background in physics. Specialized Photography is the designation applied to other courses listed in the program for the Junior year. These are designed to give the students a chance to work in a specialized field under close supervision of faculty members. In the case of medical photography students these two courses would be devoted to motion picture work starting in the autopsy room and then advancing to surgery, including clinical photography and gross specimen work. A student who wishes to specialize will find in these two courses and his special problems course in the senior year a chance to expand his knowledge in all phases of medical photography or to concentrate on specific phases in which he is either weak or desirous of specializing. The student should avoid specialization until he has had experience in medical work and is capable of selecting a field in which he knows he will be qualified and knows that a demand exists. He should strive to be a general practitioner first and then become a specialist if the situation warrants it.

Senior Year: The final year is devoted to completing the general and specific degree requirements. Minors which have not been completed must be satisfied at this time. The student should have definitely decided on those subjects to be used as minors before the Junior year and preferably before the Sophomore year. The courses in American National Government and American State and Local Government are required in some states of all Bachelor candidates and are most conveniently taken during this year. The course in Special Problems (Photo 400) is somewhat similar to the two Junior courses in specialized photography but is of a more technical nature. This course is particularly designed for an undergraduate thesis problem. It could be devoted to any field of medical photography or possibly directed to preparing a folio suitable for presentation to future employers. The folio would be patterned after the graduate thesis form and would serve as an undergraduate project. It need not be general but should be directed to solving a problem or demonstrating research ability. An undergraduate may take only four hours of "400" work. Field Photography is designed primarily for science students who are particularly interested in nature photography. This course is usually offered only during the summer but plans under way will make it both a regular term and a summer course. It is a good course for the medical photographer to have a means of purposeful variation. Additional hours arranged for the student will be selected on the basis of his individual needs. Portrait photography is very useful in clinical work and certainly would be of measurable advantage. It is strongly recommended but not required. Courses in Bacteriology would be good as electives but the need for being able to identify bacteria in research photography laboratory is not as important as histological identification. Art should be considered as almost an essential minor for the medical photographer, especially if he intends to double as a medical illustrator.

Whatever the course plan might be, it must be complete and adequate to cover the multitude of needs confronting the professional medical photographer. To be properly equipped, both in background and ability, is very important to the satisfactory fulfillment of routine and specialized phases of photography. If the student can get not only photographic training but also the academic background, he can establish himself in a better position in his profession and at the same time advance the standards of that profession.

It is obvious that the standards will shortly undergo a serious study so that many justifiable complaints may be eliminated. A person who does not consider the need for regulation or feel that it is worthy of consideration is not of a serious frame of mind and possibly stands to suffer by constructive advancement of the association. The primary purpose of any association is to advance

its standards from year to year and to be continually on the move to perfect its organization.

Be it qualification examinations or proper schooling, the important factor to remember is that there must always be the incentive to advance and improve the basic standards. Actually, there is both a need for examinations and formal training. This paper is devoted primarily to the academic approach, but it should also advance the problem of satisfactory qualification of members as well. The more specialized the training, the more pointed will be the qualifications.

COURSE DESCRIPTIONS

(Numbers following course name are those of the University of Houston. For details their catalog should be consulted.)

PHOTOGRAPHY

141; 142: FUNDAMENTALS OF PHOTOGRAPHY. Demonstration, practical field and laboratory work under close supervision accompanies classroom study of the arts and sciences related to photography. Designed to fulfill freshman science requirements for the Bachelor of Arts Degree. Three lecture and three laboratory or demonstration hours per week.

223; 224: RETOUCHING. This course offers theory and practice in the retouching of various kinds of negatives. It includes the theory of reading a portrait negative. The student is introduced to problems in the retouching of negatives for commercial and other uses. By adequate retouching the student is able to produce a negative with superior printing quality. One lecture and three laboratory hours per week.

340: BIOLOGICAL PHOTOGRAPHY. Basic photography designed primarily for biology majors, but applicable to other fields of science. This course permits advanced students to learn the fundamentals of scientific photography, the use of standard and specialized equipment, and photographic materials. Three lecture and three laboratory hours per week.

341; 342: COLOR PHOTOGRAPHY. Classroom and laboratory demonstration with emphasis on color theory. Color comparisons with the latest proven processes and materials. Experiments in determining color temperature. Determination of density gamma, and curve plotting in connection with the latest type densitometers. Correct color methods of studio lighting. Commercial adaptation to specific items. Color printing with the dye transfer process. Advanced description of any new color materials and procedures as they become available. Three lecture and three laboratory hours per week.

349: FIELD PHOTOGRAPHY. (Summer only.) Outdoor photographic problems in biology, agriculture, ornithology and other fields of science. Equivalent to three lecture and three laboratory hours per week.

400: SPECIAL PROBLEMS. Advanced problems.

440: PHOTOMICROGRAPHY. A course designed primarily for biology majors, but applicable to other fields of science, who wish to further their work in scientific photography as applied to photomicrography. Emphasis is placed on producing photomicrographs for the purpose of scientific illustrations. Two lecture and six laboratory hours per week.

443;444: SPECIALIZED PHOTOGRAPHY. A course designed to permit the photography major to study under supervision the advanced problems in his field of specialization; color, scientific or general. Three conference and three laboratory hours per week, or equivalent.

BIOLOGY

144: GENERAL ZOOLOGY. This course is devoted to a study of the vertebrate and invertebrate animal with special reference to man. Three lecture and three laboratory hours per week.

146: HUMAN ANATOMY AND PHYSIOLOGY. A survey of elementary cytology, histology, and general physiology is followed by the study of the structure and life processes of the various organ systems of the human body. The extensive laboratory work includes anatomical studies and the basic physiological experiments. Three lecture and three laboratory hours per week.

BIOLOGY

237-238: MEDICAL TERMINOLOGY. This course is arranged to acquaint the secretary with the medical terms used by physicians when dictating medical cases, reports, records, and other related materials. Special emphasis will be given to the correct pronunciation, use, and meaning of medical terms.

445: HISTOLOGY. Histology of the primary tissues, followed by a brief study of organology. The laboratory work stresses the recognition of tissues and a comprehension of their characteristic structures. Three lecture and three laboratory hours per week.

446: HISTOLOGICAL TECHNIQUE. This course offers instruction in various methods of preparing tissues for microscopic examination. Six laboratory hours per week.

CHEMISTRY

141-142: INTRODUCTORY GENERAL CHEMISTRY. (For Science Majors). The general outline for Chemistry 143-144 is followed, additional emphasis being placed on problem working and laboratory work. The laboratory work of the second semester is concerned with qualitative analysis. Three lecture and six laboratory hours per week.

341-342: FUNDAMENTALS OF ORGANIC CHEMISTRY. Required of chemistry and engineering majors. The more important classes of organic compounds are correlated. The theory and the practice of standard organic laboratory technique are studied in the laboratory during the first part of the course. Preparations representative of some of the common classifications are made. Three lecture and six laboratory hours per week.

Photography as a Tool in the Medical Sciences

B. S. KLINE, M.D. and WILLIAM STEVENSON*

THE eye is an excellent camera. It contains a living lens, an iris diaphragm and an eyelid shutter. Vision is really continuous color photography on the retinal screen with almost instantaneous transmission to the occipital lobes at the back of the brain. Innumerable tiny cells there, develop countless color prints that, more than other senses do, reveal the beauty and the order of the world in which we live.

Curious, imaginative, inquisitive, ingenious men devised the camera and discovered the silver halide process of photography. Advancement in this field has been rapid and continues so. The Dageurreotype is now of historical importance only. In place of crude cameras and simple halide emulsion yielding brown and off white prints of objects that reflect the light, the camera of today with remarkable films of silver halide base and superimposed reseau of minute red, blue and green filters or layers of cyan, magenta and yellow dyes is now a fairly good artificial eye. The cinematography of "Annie Get Your Gun" in technicolor is a great photographic achievement. So, also is the color cinematography of surgical operations, of characteristic gaits of patients with brain lesions, and of normal and abnormal movements of orthopedic cases. In clinical medicine alone, the photography of external lesions and of those within the eye, oral cavity, larnyx, bronchus, stomach, intestines, bladder, vagina, etc. is of the utmost importance for diagnosis, treatment, and teaching. Of inestimable value also are the color transparencies and the more difficult color prints of innumerable botanical and zoological specimens.

An exceedingly important type of photography for the physical and biological sciences is that of spectrography. Material containing metallic elements is vaporized in a flame, arc or spark. The light produced is passed through lenses, quartz prism and slit of the spectroscope, to the photographic film. The spectrogram reveals lines, characteristic of the various elements in the specimen. Spectrography in medicine is very valuable, especially in studies of nutrition, drugs and metabolism.

Even more important than gross photography as a tool in the biological sciences, is photomicrography. The microscope, a marvelous instrument of mag-

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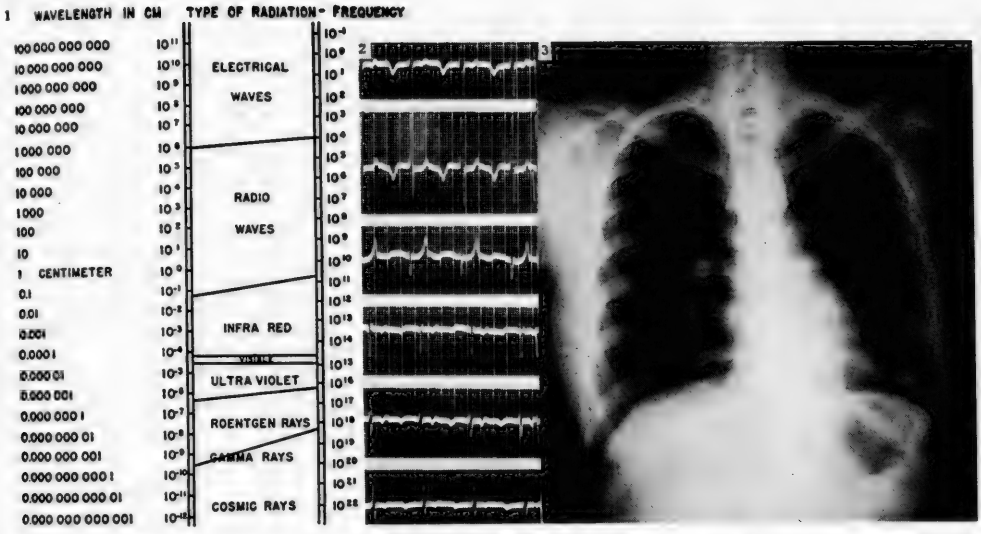

Figure 1. Radiation Spectrum. Reproduced, by permission, from "Physical Foundations of Radiology": O. Glasser, Paul B. Hoeber, Inc., New York, 1949, (fig. 5, page 31). Figure 2. Electrocardiogram. Figure 3. X-Ray Photograph (Radiograph) of Chest.

nification by glass lenses and visible light, opened a new world to the mind and made possible the development of many physical and biological sciences. Reproduction of the appearance of unstained and stained sections prepared for microscopic examination, at magnifications of 10 to 1000 times, is now recorded not only in black and white prints but also, and exactly, in color transparencies and prints. Furthermore, invaluable records have been secured by cinematophotomicrography revealing such remarkable things as the development and reproduction of normal cells and cancer cells. Think of the enormous value in identifying, recording, and teaching, of photography that exactly reproduces the appearance of all living things, a matter of over 125,000 different species of seed-producing plants and over 1,000,000 species of animals in natural size and at magnifications that reveal the minute structures that compose them.

Another important type of cinephotomicrography is electrocardiography; recording, after enlargement, the movements of a filament produced by an electric current generated by contractions of the heart. Proper recording and interpretation of electrocardiograms is now a routine procedure of great value in the diagnosis of heart diseases (Fig. 2).

In addition to photography by visible light, that by longer and shorter waves is no less important in biological studies (Fig. 1). Comparatively long infra red rays for instance have been found to more clearly reveal details such as venous

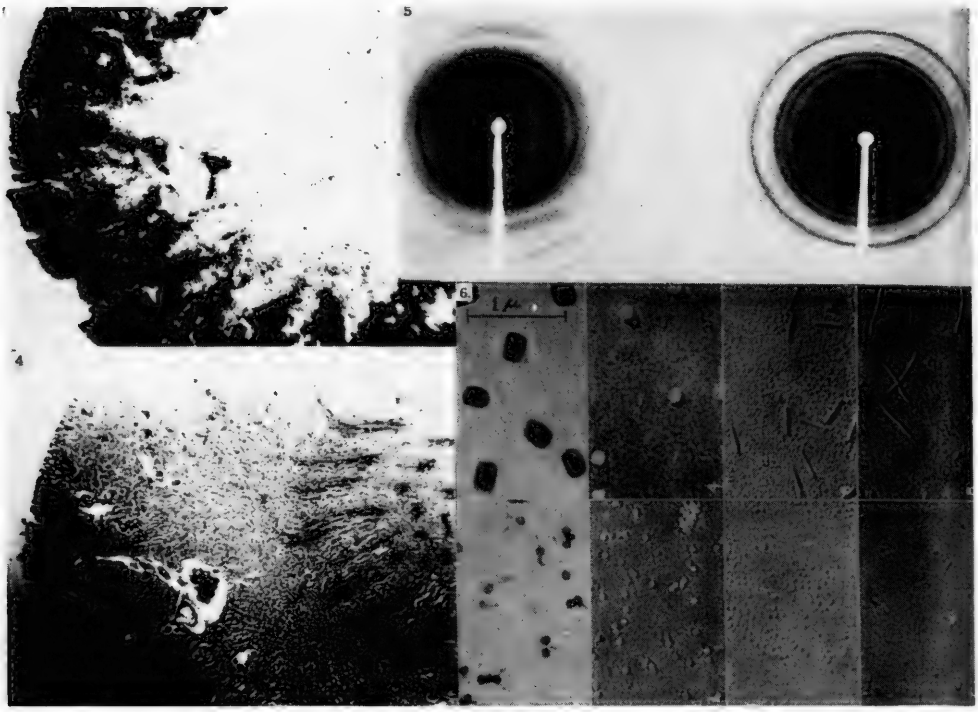

Figure 4: (Upper) Autoradiograph of rat kidney section after injection into the animal, of polonium. (Lower) Rat kidney section stained by hematoxylin and eosin. Reproduced, by permission, from "The Physical Principles and Techniques of Autoradiographs", George A. Boyd, J. Biol. Photog. Associ. 1947, 16:67. Figure 5. X-Ray Diffraction Pattern of (left) Cholesterol Gall Stone and (right) Pigment Gall Stone. Reproduced, by permission, from "X-Ray Diffraction Studies in Biology and Medicine", Spiegel-Adolf and Henny, Grune and Stratton, Inc., New York, 1947, (page 197). Figure 6. Electron Micrograph of various viruses. Reproduced, by permission, from "Nucleoproteins and Virus Activity", C. A. Knight, Cold Spring Harbor Symposium on Quantitative Biology, 1947, (Vol. 12, page 116.)

patterns and pathological changes within the skin, than do the smaller ones of the visible spectrum. The very small and very penetrating X-rays reveal details of internal body structures not obtainable with the longer visible light waves and far more precisely than can be detected by clinical inspection, palpation, percussion and auscultation (Fig. 3).

Radiographic diagnosis of many diseases and disorders quickly became an established routine in medical practice throughout the world. In addition to ordinary radiographs for pathological lesions, X-ray cinematography following ingestion or injection of opaque material, reveals normal and pathological physiology and pathology of the esophagus, stomach, intestines, kidneys, bladder, lungs, and blood vessels by normal or abnormal filling and movement of these organs.

The localization of radioactive material present or injected into animals by autoradiography of emitted alpha and beta rays is now being explored in tracing the behavior of substances within the body (Fig. 4).

Many objects, invisible through the light microscope, may be observed now through the electron microscope, which has the capacity to cast an image of them. This instrument employs electromagnetic lenses and penetrating very small, high frequency rays. The domain of viruses is now being explored and these very minute structures recorded by such photography (Fig. 6). The application of gamma rays and cosmic rays in photography remains for the future.

The most mysterious photography of biological specimens today is that by X-ray diffraction (Fig. 5). The recorded patterns reveal the actual arrangement of the fundamental atoms and molecules present.

The following is a summary of the various types of photography employed in the biological sciences in the order of the length of the rays affecting the photographic emulsion.

1. Photography by infra-red radiation
2. Still and cinephotography (visible light)
    A. Black and white
    B. Natural colors
3. Still and cinephotomicrography (visible light)
    A. Black and white
    B. Natural colors
    C. Spectrography
    D. Electrocardiography
4. Photography and photomicrography (ultraviolet)
5. Still and cineradiography (X-ray)
6. X-ray diffraction
7. Autoradiography
8. Electron micrography
9. Radiography (gamma rays)
10. Radiography (cosmic rays)

The principal uses of photography in hospital practice were pointed out clearly by Dr. F. C. Sutton[1] several years ago. In our institution they are as follows:

1. For diagnosis and record (a) of clinical cases: Radiographs, electrocardiograms, color transparencies and color photographs. These are frequently repeated to follow the course of the disease or disorder and in certain cases to show lesions before and after treatment.

2. For diagnosis and record of pathological tissues: color transparencies, and black and white and color prints of gross specimens and black and white and color photomicrographs.

3. For undergraduate teaching of students in nursing, medical technology and medicine, and post graduate teaching of house and attending physicians: All of graphs mentioned above, including black and white and color transparencies and prints of charts and tables.

4. For addresses, exhibits and publications: All types of graphs as in teaching.

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Editorial–Outstanding Papers

The speaker was sitting near the front and appeared promptly when his paper was called. The first sentences told what his paper was about and its relation to previous work. His own contribution followed in good, clear, understandable language. Each slide had only one central idea and was readable by those in the back rows. His photographs were free from distracting, extraneous matter and the subjects showed clearly against unobstrusive or contrasting backgrounds as were required. The slides were in order, and the time it was necessary to hold a filter before the projection lens, it was done without any discussion between him and the projectionist. (He had arranged that before his turn came.) He was friendly toward the audience and the microphone. No words were lost when he turned to point to the screen, because he stopped speaking until he was back to the microphone. All his sentences were definite and integrated, rather than a series of words interrupted by and-uhs, or silent periods of meditation. His delivery was interest compelling, neither a monotone nor evangelistic. He summarized his contribution and easily finished within his alloted time so that a lively discussion could follow this outstanding paper. Thus, the chairman was freed from the embarrassment of calling time on him, no one was bored by an overlengthy talk and everyone hoped to hear him again.

Last year the prize for the oral paper went by a narrow margin to an old-timer in the Association. A young lady giving, I believe, her first paper received almost as high a score. Every one has a good chance for this year's prize. Let's have unusually good papers! A written paper can be read successfully when it is done with good expression. An occasional look at the audience helps hold

interest. It is usually more effective when the speaker tells his story directly, or from brief notes. Human interest is well worth while, although attempts to be funny rarely succeed. Be at ease, trousers or skirts keep the audience from seeing shaking knees.

Much the same can be said for written papers to be published. They have to be better organized as there is no way to explain or to elaborate when the reader looks puzzled, as the oral speaker can and often does. Punctuation should be used to group the words into meaning just what you wish to say and to aid reading. They should show the style of the individual rather than follow any particular copybook's rules. The writing should be neither telegraphic nor long-winded. Illustrations should be clear and free from unnecessary matter. By all means submit illustrations in the same proportion as the size of the Journal page. Otherwise the Editor has to make them fit and hope he has retained what the author wished his reader to see. Labels should be large enough to be readable after reduction. If in doubt write the Editor, preferably sending a rough draft of the paper. Happy is the Editor who receives illustrations mounted to fit the page size when reduced a quarter to a half off so the budget does not have to stand the extra cost of unusual reductions and does not have to stay up late cutting and mounting them before he can have the manuscript ready to send to the printer on the morrow.—O.W.R.

Tentative Procedures Proposed for B P A Exhibitions

(Mr. Lou Gibson presents the following recommendations, based on information from Horton, Massopust and others concerned with prints and slides at our Annual Meetings. These are now only suggestions. Shall we accept them or can you help us improve them? Send your comments to our Secretary, Mr. Varden. — Editor.)

ANNUAL SALON

1. Member- and Open-Exhibition.
2. Five Categories: monochrome prints; color prints; 2 x 2 slides; large color transparencies; special displays.
3. Two Sections: Members' Show; Open Exhibition.

   (Members allowed one entry in one category except special displays that automatically hang; this assures that each one is represented with his best record of the year. Members and professional non-members can enter up to 4 examples in each category for the Open (judged) Exhibition; this is to interest and gain new members.)

4. Entry Fees: $1 for each category to Members and non-members in Open Exhibition; none in Members' Show.
5. Hanging: Members' Show to be hung in Chapter Groupings; Open, by classes, (V.A. as a group). Hanging to be done before Convention. (Suggest Convention to be held Monday, Tuesday, and Wednesday, to permit hanging and judging to be done previous weekend.
6. Four Classes: Each category to be divided into following: Clinical; Specimens, gross and macro; Photomicrographs; Natural Science.
7. Awards: One ribbon and one honorable mention in each Section Category and Class — 40 in all. Stickers for each "hung" entry. No popular vote.
8. Judging: To be done in advance for awards, and acceptance and weeding in Open Section. One BPA Member, two non-members on panel. Their names should appear on Entry Blank.
9. Designation of Section and Class to be done by Exhibitor. Omission or error in this to be corrected at discretion of Local Salon Committee.
10. Entry Blanks to be in hands of National BPA Secretary by June 15. Entry deadline two weeks before Salon. Printed by local Salon Committee. Sent to members and list of biological photographers by National Secretary. National Salon Chairman to cooperate in finding such lists. Entry blanks coming in with prints to be filed by Local Salon Chairman for three years. Blanks should have space for designating permission to use entries in Travelling Salon, sic.
11. Catalog of Exhibition to be printed later as a supplement to Journal of the Biological Photographic Association. That issue to be sent all non-member entrants as part of their entry fee and to advertise the Journal.
12. Mounting: Suitable sized mounts up to 16 x 20 inches (except in Special Displays category) for all prints. A series to be limited to three mounts. Transparencies to be submitted as slides or bound flush to the transparency. Only series transparencies can be on cards and one series is to be placed on or confined to a 14 x 17mount.
13. Series must tell a connected story and only one per entrant allowed and only in the Open Section.
14. Slides to be shown by projection only to save on illuminator needs. Suggest the second night of the Convention, when most attendants are there. Exhibition awards could be announced at the same time to shorten banquet-night business.
15. Notification Card should be sent each entrant as soon as possible after the judging to add prestige.

TRAVELLING SALON

A. A selection of permitted prints should be made by the Local Committee to form a fifty-print Travelling Salon.

B. The local Chapter should have the responsibility for circulating that Salon for the ensuing year and returning it afterwards.

C. The Exhibition entry blank should have a space for the Entrant to write in a possible sponsor for the Travelling Salon.

D. All correspondence for a Travelling Salon routing should be referred to the incumbent Chapter.

E. The ten best prints in each Salon should be acquired by that Chapter, if possible, for a Permanent Collection.

F. The Permanent Collection should be in the custody of the National Salon Chairman for special events and for filling-in when the current Travelling Salon is over-booked.

Once a set of Procedures has been arrived at they should go into the BPA Committee Procedure book.

It shall be the responsibility of the National Salon Chairman to remind the "Convention" Chapter, in March, of the need for preparing Entry Blanks and for their making other Exhibition arrangements. He shall also act as advisor and interpreter, but the BPA Board of Directors shall exert any controls needed. In submitting a bid for a Convention, a Chapter must accept the responsibility for running the Exhibition and Salon in the manner directed by the Board.

H. L. Gibson,
Chairman, Salon Committee.

Fellowship

To be eligible for election to the Fellowship of the Biological Photographic Association, a candidate must have been a member of the Association for five continuous years and possess one or more of the following qualifications: 1) Superior craftsmanship in still or motion picture photography of biological subjects; 2) Influence on the whole field of biological photography through sustained activity in the Association; 3) Activity in photographic research in new methods or materials. To propose a candidate for the fellowship, obtain an application blank from Miss Anne Shiras, University Office, Magee Hospital, Pittsburgh 13, Pa. Two sponsors are required and such reprints, photographs, or other evidence of the candidate's ability as may be required by the Fellowship Committee. Questions should be referred to Mr. Harding, Chairman, or to Miss Shiras, Secretary, of the Fellowship Committee.

Modification of the Zeiss-Nordenson Retinal Camera

MARGARET MARKHAM*

A. Historical Background

THE value of colored drawings of the fundus oculi, both in teaching and in recording of pathologic conditions, was well recognized in the nineteenth century. However, with the improvement in photographic equipment during the twentieth century, it became feasible to supplant the earlier drawings with actual clinical photographs of the eye grounds, first in black and white and later in color film.

As early as 1862, Noyes in America made attempts to obtain photographs of the fundus. Similarly, G. Bagneries experimented with elaborate equipment in Nancy, France in 1889. Shortly thereafter, 1891, Gerhoff developed a technique of flare free photographs by immersing the eye in a water chamber with a plane front of glass.

Sigurd Hagen experimented with diascleral illumination, while Dimmer in Vienna obtained black and white fundus photographs with the use of cumbersome equipment.

It was not until 1915, however, that Nordenson at Upsala University in Sweden, obtained photographs of the eye grounds covering a breadth of diameter of 40 mm. With further experimentation, the Zeiss-Nordenson Flare Free Retinal camera was developed in 1926, following the principles of the Gullstrand reflectionless central ophthalmoscope, i.e. the image forming rays pass through the central area (the optically more important area) of the patient's pupil, while the illuminating rays enter the periphery of the dilated pupil and diffuse over the retina. In their respective passage through the refracting surfaces of the eye, the two beams travel in separate paths, thus ensuring freedom from internal reflections and haze on the final image.

In the later models of the Zeiss-Nordenson camera, an aspherical objective was utilized with a focal length of 60 mm and an aperature of 50 mm.

Since the Zeiss-Nordenson camera, like others before it, had been conceived and manufactured in the period before color film was generally available, there arose certain technical problems relating to light source and practical film holders for use with color film when it was put on the market.

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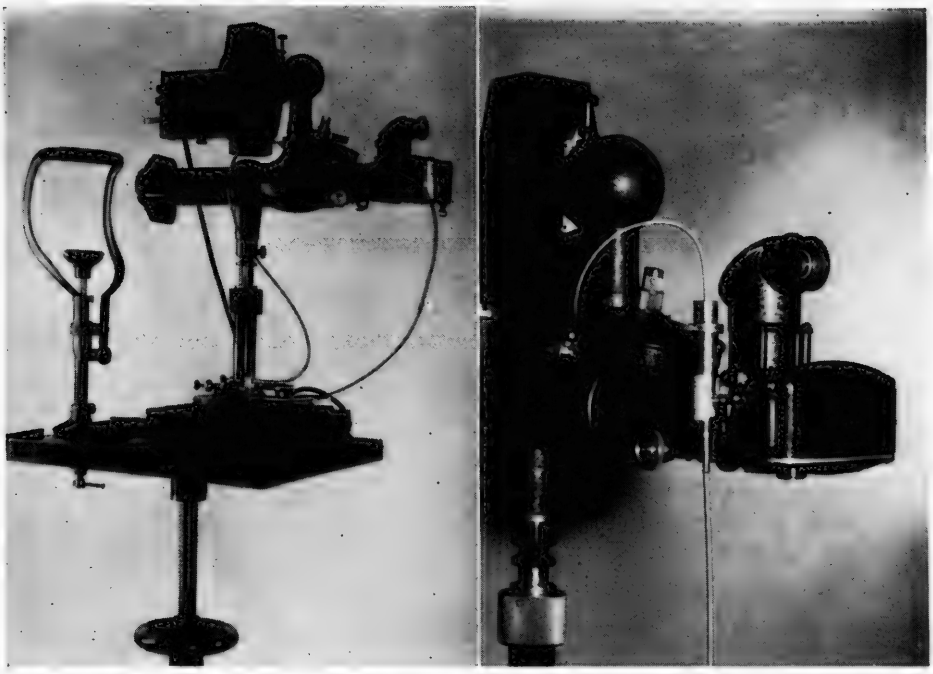

Figure 1. (Left) Zeiss-Nordenson Retinal Camera in original form showing double cable releases without internal synchronization. Rollex back and sheet film holders used on this model.

Figure 2. (Right) Zeiss-Nordenson Retinal Camera modified. Note new synchronized cable release mechanism and Kodak Bantam back for either color or black and white roll film.

B. Modification of the Film Holder

Replacement of the original single sheet film holder or of the flimsy Rollex back (not a Zeiss product) which was utilized in some instances, is best achieved by the use of a standard, inexpensive Eastman Kodak Bantam back**. This camera back requires standard size 828 film in either black and white or color and it can be loaded as simply and as rapidly as any box camera. Eight exposures can be made before reloading of the film is required, figure 1.

In adapting the Bantam back, however, the plane of the film will no longer coincide with the original film plane. A compensating adjustment must therefore be made in the ocular of the camera, to assure that both the plane of focus and the plane of the film will be finally identical and will yield pictures in proper focus. This modified film holder** has been in operation on a number of cameras for some time, including two models in regular use by the author.

** By Mr. Walter G. Kramer, 209-54 Whitehall Terrace, Queens Village, Long Island, N.Y.

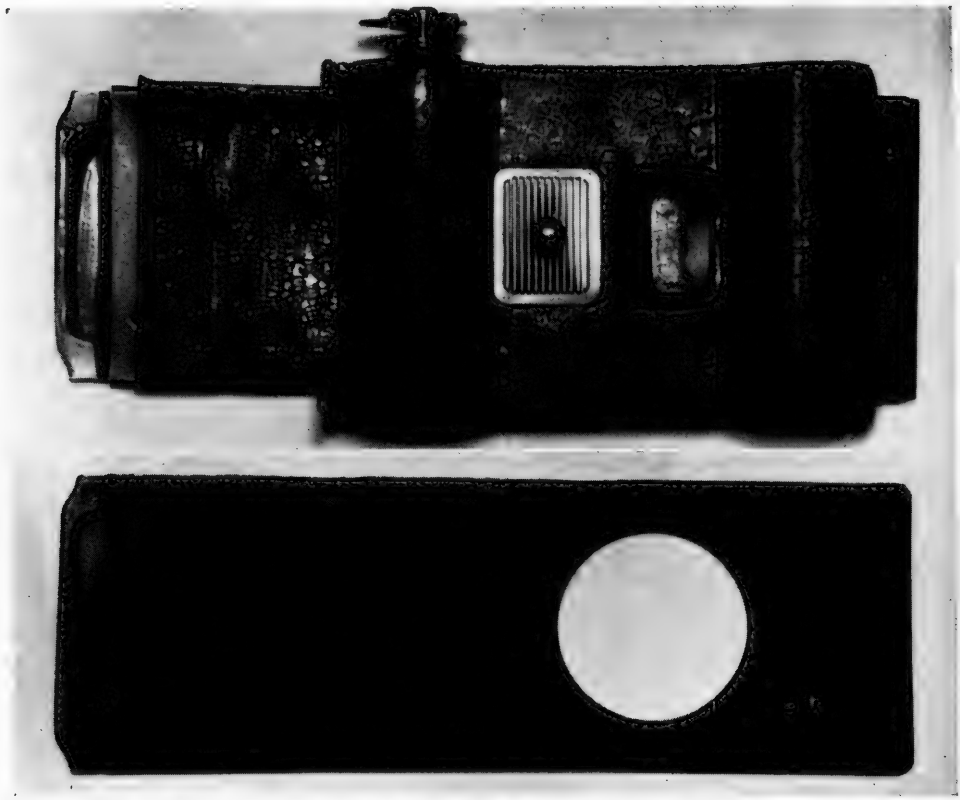

Figure 3. Rollex back mounted onto double size stereo film plate to permit single exposures as well. Slide and mask for above camera back is shown below it.

C. Modification of the Cable Release Mechanism

The several types of Zeiss-Nordenson camera employ the various cable releases required for synchronizing the steps necessary in making an exposure: *i.e.*, raising of the focusing mirror; release of the Compur or mechanical shutter; transporting of the focusing filter to allow full intensity of illumination to pass through the lens for the duration of exposure.

Most of the original synchronizing mechanisms are undependable, errors arise from failure of the mirror to rise at the proper moment; to rise to full height; or to rise at all. This results in cutting off a part, or at times, nearly all of the aperture through which the light passes to the film to produce an image. When the aperture is thus cut off, only a partial picture is produced or sometimes the film is left entirely blank.

In nearly all models, fig. 1, the double cable releases required for the above procedure are operated by means of a hand plunger which sometimes fails to keep

Figure 4. Normal fundus of brown-haired individual, showing optic nerve and lamina cribrosa through which vessels emerge to spread over the retina. Lighter blood vessels are arteries; darker ones are veins. 16X.

the cable releases taut, thus permitting them to "buckle" and loose the necessary tension to keep them in proper functioning condition. Neither is it possible to check synchronization visibly, easily, or with certainty with this type of plunger.

A new type** of *single* cable release mechanism, fig. 2, operated by a piston-like device mounted near the camera back, has been installed on a number of the Zeiss-Nordenson fundus cameras. The advantage of this mechanism lies chiefly in that it allows instantaneous and fool-proof adjustment of the synchronization by the photographer. The cable release is mounted in vertical position on the camera, permitting it to hang straight and to be used in a manner that retains its tension and effectiveness.

With this modified cable release mechanism, an exposure can be made only when the mirror has been *raised completely,* since the shutter of the camera will open only when the mirror is in position to allow the full aperture of light to pass through.

D. Modification of the Stereoscopic Model

The stereoscopic, binocular model of the Zeiss-Nordenson camera, can be readily converted for use as a monocular, monoscopic instrument for obtaining single frame exposures. Without interfering with the stereoscopic operation of the camera, a regular Rollex back can be mounted into one of the stereoscopic sheet film holders regularly supplied with this model, fig. 3. This enables use of the Bantam size Kodachrome film as in the regular model of the Zeiss-Nordenson camera. The modified back is mounted in such a fashion that focusing is done through the left-hand ocular which has cross-hairs and is adjustable. The author utilized Ektachrome cut to size for stereoscopic exposures and Kodachrome for monoscopic exposures. Interchangeability of the two types of film holders permits both types of records to be made on the same patient. (Fig. III).

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Cover Picture

Fundus showing pathological changes due to degenerative processes including sclerosis of the choroidal vessels. Enlargement showing the emergence of blood vessels from the optic nerve.

JOURNAL INDEX

A few copies of the Cumulative Index for the first 17 volumes of the BPA Journal (1932-1949) are available and may be purchased for $1.00. Send remittance to the Editor, 70 Alton Road, Stamford, Conn. Checks should be made to the BPA.

Filing and Classification Methods of Photographic and Illustrative Material

MARGARET SCHELL*

Part I — Operations and methods of various photographic departments.

"CLASSIFICATION IS IN ITS SIMPLEST FORM THE PUTTING TOGETHER OF LIKE THINGS"[1].

Efficient filing and classification methods afford a considerable saving in time, cost and effort and are instrumental in building up good will and co-operation among individuals and departments concerned. Not only commercial and industrial, but also scientific and allied institutions have become increasingly aware of the need for practical record management and schools are more and more beginning to fill this need by offering courses in its basic principles and practical application.

Due to space limitations, only a brief and condensed survey of some of the most prevalent classifying and filing systems and arrangements will be given and suggestions will be offered regarding the practicability of certain methods. The material to be classified may consist of slides (projection or lantern), photographs, negatives, films, models, charts, and specimens of all kinds; in short, all such valuable teaching and research material which serves educational purposes not only within the medical profession but also for the general public. It is also highly useful in the compilation of statistics, for medico-legal purposes and is of benefit to patient, hospital, school and in resident and intern training programs. This material is not only similar in its organization and application to the now justly recognized medical record and patient's charts, but is often integrated into the medical record proper and is classified and indexed in the same manner.

Most classification systems are concerned with the setting up of code or key numbers and/or letters and the most practical ones include mention of both the anatomic structure (location) and the cause or etiology of the disease. This is a very sound basis of classifying the medical material. Attempts at standardization and valuable contributions in this direction have been made by Malcolm D. MacEachern, M.D.[2]; Edna K. Huffman, RRL.[3]; The American Medical Association[4]; The Army Institute of Pathology.[5]

In *A Handbook of Medical Library Practice*[6] the editor, Janet Doe, lists five major classifying systems, namely: The Dewey Decimal System; Library of Con-

* Photomicrographer, 536 W. Arlington Place, Chicago 14, Ill.
Received for publication April 2, 1951.

gress Classifying Schedule; Boston Medical Library Scheme; Cunningham's Classification for Medical Literature and Barnard's Classification for Medical Literature, and numerous other methods, less widely known and used. A system not unlike the Nomenclature of Diseases by the American Medical Association is one drawn up by a Joint Committee appointed by the Royal College of Physicians of London.[7] This nomenclature is characterized by the thorough list of eponyms and the fact that it is used without any numbers or letters. It appears that few institutions use the Ponton system any more[8]. Dr. Ponton's name now appears in the AMA nomenclature of operations as one of the members of its Committee on Medical Nomenclature.

For those interested in the Punch card system, I will cite a reference which appeared in *Science* in 1946[9]. This particular number also contains an article on a new classification system for chemical compounds[10] and a practical idea for a reprint filing system[11]. In a recent issue of the *Journal of the Biological Photographic Association,* and in his talk before the Biological Photographic Association's Convention in 1949 in Cleveland, Thomas T. Hill presented detailed data on photographic applications of the punched cards.[12]

The present wide variety in arrangement and integration of photographic departments and their classification systems into schools, hospitals and scientific institutions is apparently determined by several factors:

a) The manner in which the photographic work is integrated into the respective institution: one separate photographic department; a general photographic and/or illustrative department and a number of other photographers working independently of the main department in other sections; part time photographic work done by various individuals within the same institution; again, part time photography incorporated into or affiliated with the medical records department, audio-visual medical education department, medical library, roentgenology or pathology department.

b) The department having jurisdiction over photography: the administrative office directly, the pathology or less often, the roentgenology department. This may determine the chief work of the department.

c) According to the manner in which photographic work is paid for: by the institution directly or indirectly, or whether the photography is done privately by surgeons, attending physicians or residents, interns or anyone else possessing a camera and desiring to do photographic work.

Privately done photographic work does not benefit the hospital or institution, as such work often does not measure up to a professional standard nor does it become the permanent property of the hospital or school. Residents doing photo-

graphic work usually take their rightful property with them upon leaving, so the value of such material is doubtful and transitory, at least as far as permanent teaching and research purposes and value to the hospital staff and patients are concerned. Filing or recording of such material is in such cases almost always completely dispensed with. I would emphasize the full time employment, or at least part time employment, where the former is not feasible, of a qualified and versatile photographer able to photograph gross specimens, do microscopic work, clinical photography, x-ray reproduction, etc. and who is skilled in the making of projection or lantern slides both in color and monochrome. Adequate space and a minimum of working equipment should be provided. The photography department should not be relegated to poorly lighted and ventilated, damp basement corners. After all, a photographer worth his or her salt should be considered a skilled technologist and should have the standing and prestige this profession deserves. Patients should not be subjected to being photographed in a depressing and undignified atmosphere.

In this connection mention should be made of the distressing fact of the low or just average salaries being paid many skilled photographers especially in hospitals. This may be due to (1) the general concensus of the medical profession often being that photographers' work can easily be done by anyone not experienced or trained in such work and (2) that photographic departments in the majority of cases that I have seen, are not made to be self-sustaining financially, not to mention profitable. Thus, they may well be considered more of a financial liability than an asset by the respective administration. Those medical doctors who give their photographers credit in print upon publication of their work, are rare and are to be commended for their thoughtfulness to a profession, whose members I have found to be possessed of high standards, a great willingness to improve constantly with rapidly changing times, and integrity and honesty of purpose.

An institution such as the University of Chicago with its affiliated five hospitals and 35 clinics requires a wide variety of photography and its department of photography under the able direction of its chief photographer, Mr. Jean Crunelle, commands the most up to date equipment and supplies in keeping with their photographers' skill and training. This department appears to function extremely well and has, so I am informed "no headaches or troubles" as far as record keeping is concerned. Incoming orders are automatically placed in envelopes and numbered consecutively. Records are only kept of kind, amount, price and incidentals related to the order. When the order is filled, all work leaves the department and no prints, slides are negatives are kept in it. Thus, a great deal of time obviously is saved while on the other hand, the material is scattered among numerous departments or individuals and is lost for the purpose of centralized medical education material or integration of disease entities. Every de-

partment has laws of its own and possesses its own print or film file. Many fields of medicine quite naturally overlap and so, a centralization of pictorial material along co-ordinated lines would be of much value. Many pathological conferences present surgical specimens and slides of microscopic pathology together with roentgen films or slides of any one particular case and project cardiological interpretations at the same time. Here we have a true picture of all major factors for efficient evaluation and correlation of certain diseases which could be just as well adapted to a central medical museum of illustrative and other records. Duplicate prints are made at the University of Chicago's photographic department and placed in the patient's chart in the Medical Records Department where a photograph can be retrieved if the original print or negative becomes misplaced. At this writing, over half a million charts are housed in the Medical Records department where they are held for 5 years and then micro-filmed and stored. Everything as far as filing is concerned, depends on the patient's number which remains the same, even for subsequent admissions. Although the bulk of photographic work is done by Mr. Crunelle's department, there are other independent photographers scattered over the various university and clinical departments, as is the case also at the University of Illinois.

At this university I found that the brilliance and prominence of the Medical Art Department, headed by Mr. Tom Jones, overshadows the smaller central photographic department but not the work done by some of the lady photographers affiliated with certain clinical departments. While Northwestern University also has its main photographer and affiliated hospital and clinical photographers, it differs in the general arrangement in that its well equipped and competent photography department is under the complete jurisdiction of the Chairman of the Pathology Department, as are the Art Department and Audio-visual Medical Education Departments. The latter has recently been incorporated into the Medical Library. It served as a clearing station for educational films and slides for the medical school and the Evanston campus.

The affiliation of pathology with photography seems a logical one, since the former probably uses photography more than any other medical field, with surgery a close second. The Pathology department of Northwestern Medical School possesses sizeable collections of pathalogy slides in color and black and white in addition to jars containing preserved specimens in its own Museum of Pathology. The slides are indexed by topographic, and cross indexed by etiologic code numbers in accordance with the AMA nomenclature of diseases [4] and are frequently loaned out for lectures to members of the faculty and teaching staff of the Medical School and the affiliated hospitals. In addition to the code numbers and explanatory legend, the 3 x 5 cards differentiate gross specimen pictures from

photomicrographs by designation of "Pmx" and "35" respectively. The department has in its possession also a very useful disease or diagnoses file comprising all surgical and autopsy diagnoses for the past 4 or 5 years from Wesley and Passavant Hospital's Pathology departments. There is an abundance and great variety of material, a veritable treasure chest of potential knowledge and information to be imparted to students, lecturers or researchers. While the posting and coding of "missing items" left out on the hospital sheets consumes a certain amount of time, the time and effort spent seems worthwhile because such a cabinet contains a tremendous amount of material. A large number of surgical and autopsy numbers may be entered on the lined cards, on the bottom line which is visible from the outside, are the AMA code numbers with their explanatory legends. A pathological reprint file which is among the largest I have seen so far, and a catalog of the Pathology museum specimen jars, are classified by two different systems using numerals and letters.

Slide indexes coded by the AMA system may be varied according to individual requirements. At Wesley Hospital's Medical Records Department, the cards are subdivided into: operative procedures, diagnostic procedures, electrocardiograms, diagrams, graphs and charts, and an alphabetically arranged patient's name index. The cards carry first, the AMA sets of numbers, then diagnoses, case number, patient's name, doctor's name and material. The latter is identified by Sx (slide x-ray); F (photograph); S (slide); K (kodachrome), etc. In smaller hospitals, like the Martha Washington Hospital, one may encounter the same nomenclature scaled down to smaller proportions. Here I found a very neat AMA nomenclature of disease cabinet with cards made by the Physicians' Record Co. carrying sections for patients' numbers and age, doctor's name, abbreviations for: recovered, improved or expired, and diagnoses. The slide index had cards with slide number, and an alphabetical disease index (Myofibroma-uterus under M, dermoid cyst-d; carcinomatosis-c, etc.) The pathological diagnosis was stated briefly, and notations such as admission date for surgery and other pertinent data made the whole system easy to operate and items easy to find.

Both Martha Washington Hospital and American Hospital are among those converting from the Ponton System to the AMA nomenclature, the former some time ago and the latter recently. Another system rapidly replaced by the AMA system is the Bellevue system which is described in the Chapter on Medical Record Departments in *Hospital Organization and Management,* pp. 597-694, by Dr. Malcolm T. MacEachern.[2]

A really good example of a hospital in which a large part of the photography is done and very well, by the residents in pathology, is Augustana Hospital. Some of these residents have also been responsible for devising and setting up good

photographic equipment. The AMA coding system is used here also, both by the Pathology Department and the Medical Records Department. The projection and tissue slides also show the patients' admission or case numbers. A number of hospitals have duplicate photographs made whenever a request or requisition is sent to the photographer, one print going to the doctor and the second being filed with the patient's records. This appears to be a good way of assembling all necessary information right in the patient's chart. Some institutions prefer to have a laboratory technician (Grant Hospital Laboratory) or their physiotherapist (as in the case of the Illinois Children's Hospital School) do the photography, or frequently, the Chief or one of the staff surgeons do a considerable portion of it, often in addition to a general photographer. Often in smaller hospitals, photographs are then filed with the patient's histories primarily by patient's names, secondarily by patient's admission numbers. Other hospitals find it convenient where the volume of photography is limited, to employ a lady photographer part of her time as medical secretary.

(Part II will appear in the November Issue)

Key Available to Members of 5 Years Standing

The golden key, official emblem of the BPA, is available to those who have been members of the BPA for five or more years. The emblem features a camera and microscope within a design resembling motion picture film along two sides of the key.

It may be ordered from the L. S. Balfour Company, 1601 Chestnut Street, Philadelphia 3, Pennsylvania for $8.75, plus the 20 percent Federal Tax and any State Tax applying to the sale. The price includes machine-engraving on the back of the key of the member's name (two initials and last name) and date of joining the BPA. Additional details, such as the initials FBPA, date of fellowship, charter membership, etc., may be ordered at 2c per machine-engraved numeral or letter. Prices to members not residing in the United States are higher depending on local taxes — write the Secretary for prices for foreign delivery.

A pin and safety catch can be added at a cost of $1.00 and the above mentioned taxes.

Boston Meeting - Last Call

The preliminary program material was mailed to our members last month. Chairman Harding reports all in order at Boston for the best meeting yet. Mrs. Harding has ancient and modern Boston available for the exploration of the ladies. Chairman Eddy has a fine program nearly completed.

If you are planning to show motion pictures and have not entered them on the regular entry blank, please send title, length and kind (B&W, Color, Sound, Silent) to Mr. H. B. Tuttle, 343 State Street, Rochester 4, N.Y. until September 11 and after that to him at the Hotel Kenmore, Boston. Members wishing to send films for showing should send title to him now and film to him at Boston.

Let us all go and show the Boston Chapter members that we appreciate their spendid efforts.

Book Review

A Dictionary of Biology **by M. Abercrombie, C. J. Hickman and M. L. Johnson. Penguin Reference Books. 1951. 246 pp. 10 figs. $0.50. American Agents: Penguin Books Inc., 3300 Clipper Mill Road, Baltimore, Md.**

This little, paper-bound pocket encyclopedia covers about a thousand words of biological general terms and about twice as many names of the major classification systems for plants and animals. The definitions are rather fuller than usual with dictionaries and that is why I called it a pocket encyclopedia. Most of the basic concepts of biology are included and most of the definitions are correct and adequate. For improvement one might suggest some guide to syllabication and pronunciation would be helpful to beginners. This little book will be useful to the biological photographer and the medical photographer will find quite a few anatomical questions answered. The authors teach in British universities. The dictionary has large avoided provincialism and only the specialist will be bothered by small details. — O. W. R.

Chapter News

The current secretaries of the B.P.A. local chapters are as follows:

Boston Chapter:	Lawrence Brown 188 Longwood Avenue Boston 15, Mass.
Chicago Chapter:	Mrs. Maria Ikenberg 1853 W. Polk Street Chicago 12, Illinois
New York Chapter:	Warren Sturgis Sturgis-Grant Productions 314 East 46th Street New York 17, New York
Northern Ohio Chapter:	Frank G. Minello Medical Illustration Lab. Veterans Administration Hospital Cleveland 29, Ohio
Rochester Chapter:	Only recently formed. Election of officers not yet reported.
Southern California Chapter:	Avis Gregersen Box 78 1200 N. State Street Los Angeles 33, California
West Virginia Chapter:	H. E. Sturm 209 Maple Avenue Philippi, West Virginia

On June 19th the *Chicago Chapter* met at the Illinois Eye and Ear Infirmary for a discussion and demonstration of various types of equipment for biological photography, including the new Bush Verascope Stereo-Camera; Pola Screens for use in reflection control; and a surgical motion picture set-up in an explosion-proof operation room. Members were invited to bring any of their own equipment or gadgets for presentation also.

On June 27th the *New York Chapter* met at the Victor Keppler Studios where the well-known Mr. Keppler himself discussed his equipment and general studio facilities for commercial illustration photography. The meeting proved to be extremely interesting and gave chapter members an opportunity to see the inside workings of a large commercial photographic establishment.

The *Northern Ohio Chapter* met on June 6 at the Medical Illustration Laboratory of Crile Veterans Administration Hospital. A demonstration of speedlighting was given, following which the chapter members continued their discussion on certification of the medical photographer and prices for medical photography.

The regular June meeting of the *Southern California Chapter* was postponed until July 20 in order to take advantage of an invitation received to preview two recent productions at the Walt Disney Studios. This was the second time that the chapter had been invited to the Disney Studios. The pictures previewed were "Nature's Half Acre" and "Alice In Wonderland".

Association News

A. W. Proetz, M.D., has received the de Roaldes Gold Medal which is the world's highest honor in the field of Laryngology for "Special recognition of merit and achievement in teaching, authorship and research." The medal has been awarded only six times since its establishment in 1907. His contributions to the BPA were mentioned in the citation.

Ralph P. Creer took part in the Symposium on Motion Picture Films and Film Strips at the annual meeting of the Society of American Bacteriologists, discussing the evaluation and distribution of medical films.

Edmund J. Farris has returned from London where he was invited to lecture on human fertility, a program of research he has directed at the Wistar Institute for some years.

An announcement concerning the Boston Annual Meetings was sent by the Secretary to all members in July. In addition to giving a preliminary program of activities, the mailing included an advance registration card, a hotel reservation card and a salon entry form. If by chance you did not receive this material, please inform the Secretary promptly.

The Secretary has received a number of requests from members for an up-to-date Membership Directory. It should be noted that the Association does not publish an annual directory. The latest directory appeared in February, 1950, and was mailed to all members. Only a limited number of copies remain to meet the needs of new members of the Association.

It is very difficult to keep in touch with the activities and accomplishments of individual members. It would be greatly appreciated if you would report to the Secretary items which you feel would be of general interest to other members for publication in the Journal.

Members who are not associated with any one of the local chapters will be interested to know that official charters have now been granted to all existing chapters of B.P.A. (See list of local chapters in Chapter News.)

One - Shot Photomicrographic Camera

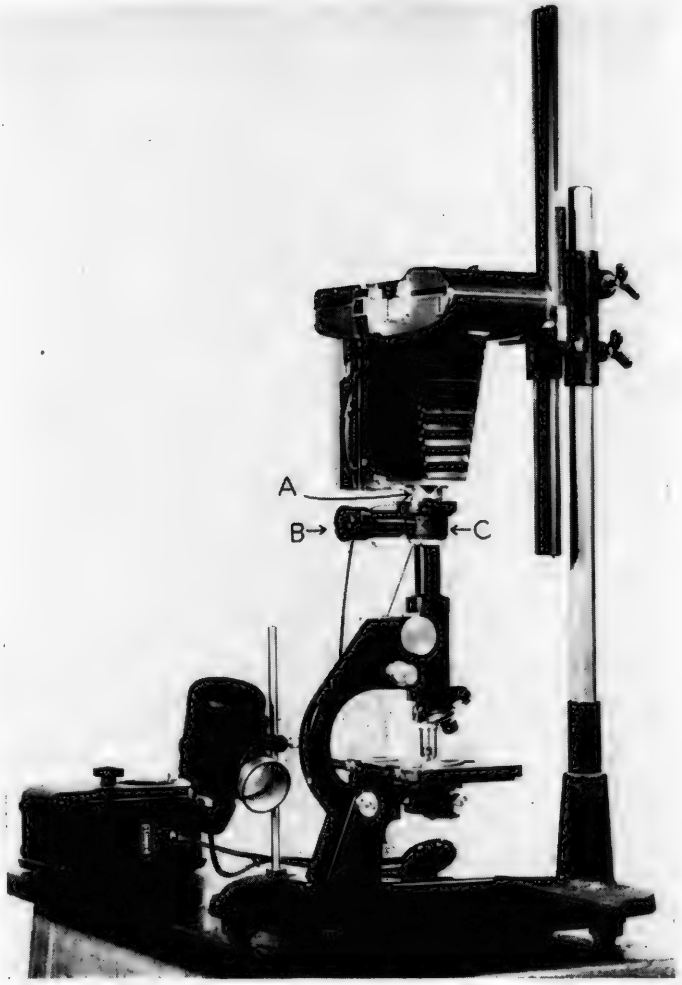
E. G. KELLER*

THE combination of a Polaroid Land Camera back with the basic stand, upright and vertical optical bench of the Leitz photomicrographic apparatus MA-IVb, figure 1, was developed in conjunction with the offices of the Polaroid Corporation in Cambridge, Massachusetts, and Dr. S. S. Ballard in particular. Dr. E. A. Hauser, at Massachusetts Institute of Technology, and Dr. T. G. Rochow, at the American Cyanamide Corporation, have tried similar combinations and they proved of great value in obtaining photomicrographic prints within one minute after exposure.

This device will be commercially available from E. Leitz, Inc. It provides a cast iron base located on four shock absorbing rubber feet, a stainless steel upright and a vertical optical bench which permits the camera to be lowered over the microscope. The vertical optical bench is so arranged that it can be swung through a circle of 360°. A standard microscope with monocular tube is used and it is provided with a split beam telescope that clamps into position over the eyepiece. The split beam prism housing has a built-in shutter with variable speeds up to 1/125th of a second. A light-tight connection is made between the camera, lens panel and the split beam prism housing. The objective which is normally supplied with the Polaroid Land Camera has been removed and the opening of the lens panel enlarged so that eyepieces of all magnifications, from 6x to 12x, may be used with it. The camera itself can be raised and lowered on a dovetail slider on the vertical optical bench, and may be clamped into any desired position. The source of light is a standard microscope lamp, such as the Leitz Monla Lamp 6 Volts, 5 Amperes, which supplies satisfactory illumination for all photomicrography from the lowest to the highest powers.

The lateral viewing telescope, which is part of the split beam prism arrangement mentioned above, is so arranged that the microscopic image can be observed and focused through it. The lens board has built into it an optical system so designed that the image as seen through the telescope is automatically in focus in the film plane. The focusing telescope housing (C) incorporates a split beam prism which transmits approximately 70% of the light and reflects 25% into the eyepiece (B). A wire release with set screw is provided to remove the prism from the path of rays. The prism can be left in the optical path as is very desirable when trying to photograph living objects.

* E. Leitz, Inc., 304 Hudson St. New York 13.
Received for publication March 6, 1951.



The application of this one-shot camera is extremely diverse. I have used it primarily to take pictures of pathological slides at magnifications from 100x to 450x. Since the finished print is available within one minute after the exposure is made, it can also serve as a guide to determine exposure for more universal photomicrographic setups. The film supplied by the Polaroid Corporation is orthochromatic, but panchromatic film will also be available within the near future. The Polaroid Corportion will be pleased to submit specific data on sensitivity, Weston ratings, etc., of the film which they supply. The film can be purchased in any photographic store.

The results obtained are surprisingly good, although I do not think that this will ever replace the standard photomicrographic camera. It certainly will prove valuable for the purpose of making temporary, or permanent records within one minute after observation. Just picture the rapidity with which a finished photomicrograph could be presented when a pathologist is called upon to make a diagnosis from a biopsy! The small hospital laboratory which cannot entertain the expense of a photographic laboratory could have finished prints within a minute.

I think that this one-shot camera will give impetus to the ever-growing desire to take photomicrographs. It cannot and will not replace large photomicrographic units which are much more versatile and more flexible for not only taking microphotographs, but macrophotographs, gross photographs, etc. Most important of all, the selection of magnifications and field of view is limited to a certain extent with this one-shot camera. In the hands of an unskilled photographer, this one-shot camera will provide for a rapid means of making photographic records which are so important in the diagnosis and evaluation of case histories.

Dr. John Fallon

On June 22 this Association lost a prominent member when Dr. Fallon died of a heart attack. After graduating from Holy Cross College he studied at Harvard and received his medical degree in 1923. John was a former fellow of the Mayo Clinic and was Director of the Fallon Clinic in Worcester and a surgeon for several hospitals. In 1942 he received the honorary doctor of science from Holy Cross College and two years ago was named a Fellow of the International Society of surgery in recognition of his standing in that field. He was a member of many medical societies, the International Society of the History of Medicine, the Physicians Art Guild, as well of our Association. Fallon did much to further medical illustration and photography at meetings of the medical profession and wrote a number of articles describing his ingenious equipment for our *Journal.* For the past year he has edited the material for a book on medical photography with Harding and Julian and one of his last requests was that this be completed. He always did a little more than asked, for our Association. His premature death at 50 years of age interrupted a very active career. For many of us it means the loss of a very fine friend who always encouraged us along the way. — OWR.

New Apparatus

Exacta Camera

The Exakta Model V is a 35mm, single lens reflex camera. The design of a single lens reflex is such, that the same lens is used for both viewing and for actual picture taking. Thus, the intended picture is under control on the ground glass until the shutter release knob is pressed. There can be no parallax errors and the image, *exactly* as seen on the ground glass, is conveyed to the film. In addition to the ground glass being a condenser lens, which provides for even illumination of the image in the viewfinder, there is a built-in magnifying lens for critical focusing.

Two types of viewfinders can be interchanged on the Exakta V—the Waist Level Reflex Hood for viewing at chest or waist level and the Penta Prism Finder for eye-level viewing. The Prism Finder provides for a lifesize, upright and laterally correct reflex image. Not only are the viewfinders interchangeable but,

Photomicrography with the Exacta camera at the School of Biology Philadelphia College of Pharmacy and Science. Upper insert, Exacta with eye level finder. Lower insert, Exacta with waist level reflex hood.

for special work, ground glasses within the viewfinders can also be interchanged. For example, where it is essential that the subject be exactly in the center of the film, center cross ground glasses are available.

The camera takes lenses from focal lengths of 35mm to 500 or more millimeters, which can quickly be interchanged in the bayonet mount. Extension tubes, available in any length, can be used in combination with different lenses to overcome focusing problems when the distance from subject to camera is fixed. For photomicrographs, a convenient microscope adapter set, with hinged clamp and short set of extension tubes, is the only accessory needed. The eyepiece of the microscope can be exchanged without dismounting the camera. Focusing can be accomplished while in a sitting position (see picture) with the Waist Level Finder and while standing with the Penta Prism Finder. For photomicrographs of magnifications over 150x, the regular ground glass is too coarse and focusing is difficult. For such work clear focusing glasses are provided as well as a ground glass having a clear spot in the center.

The focal plane shutter of the Kine Exakta V has 29 settings. T, B, slow speeds up to 12 seconds, fast speeds up to 1/1000th of a second, and provision for release through a delayed action mechanism. The slow speeds are essential for scientific photography and the self-timer eliminates any possible vibration from touching the camera to release the shutter.

The Exakta Model V is available with different lenses. Prices start at $199.50 (tax included) for the Model V with F3.5 Zeiss Tessar 50mm "T" Coated Lens.

The camera is manufactured by Ihagee Camera Works in Germany. Complete details and literature may be obtained from the EXAKTA CAMERA COMPANY, 46 W. 29th St., New York 1, N.Y., exclusive factory representative for the Exakta Cameras in the United States.

Foldomatic

Mayfair Manufacturing Company, 55 Eckford Street, Brooklyn 22, N.Y., announce their Foldomatic versatile four-light unit weighing only 2.5 pounds complete. The unit's two arms extend to 26.5 inches and fold to a compact 12 inches. The arms can move horizontally in a 180 degree swing, while the two sections, which hold the sockets, can be rotated 350 degrees. An automatic built-in stop protects the wiring within the unit. A control box between the rotating arms contains a four-position rotary dimmer switch which affords the user complete light intensity control. These positions are as follows: 1) four bright; 2) Two bright; 3) All dim; 4) off. The Foldomatic is available in camera stores for a list price of $14.95.

Mayfair also has a new FOLDOMATIC Pocket Model—a two-light unit containing the same construction features and the rotary dimmer switch. In this unit the lighting possibilities are as follows: 1) Two bright; 2) One bright; 3) Two dim; 4) off. It folds down to 6″, weighs only 1½ lbs. List price $10.95.

A removable handle permits hand held lighting, or the unit can be placed on a tripod. Both units are metal with chrome-plated sockets and swivels. The control box and arm sections are of steel with grey wrinkle finish. Both units come with 10 foot, heavy duty-cord and a black-and-white and color exposure guides.

"Transopaque", "Solotone" and "Colotone"

A relatively new alterative process which is widely used in commercial photography and the graphic arts seems to hold promise for, but has attracted little attention in, medical work. This process or, rather series of processes, is worth investigation even by the photographer who chooses not to alter photographs, because it also applies to the production of posters, charts and diagrams, the coloring of lantern slides or roentgen films and the preparation of material for exhibits.

"Transopaque", "Solotone" and "Colotone", derive from the frisket and from the cel overlay used in animation. Plastic sheets upon which dry pigment has been deposited are laid over the material to be altered, whether that material is graphic or photographic, and held in register by hinges of cellophane tape. One or several overlays can be used. Pigment and plastic both are transparent, so the underlying material is visible throughout the alterative manipulations, which consist merely

of removing the pigment after transitory chemical softening where it is unwanted, by scraping with variously shaped tools. The pigments of colotones are made from standard printers' inks, to simplify later color reproduction.

Transopaque has an orange-red pigment, visually transparent but photographically opaque, which is used for simple opaquing of parts of a negative. Its advantages are that one can see the underlying material; that mistakes are easily corrected by returning pigment to the plastic and that the negative itself remains uninjured by the alteration.

Solotone sheets are grays and whites in various (5 each) concentrations. Colotones come in 10 colors, with 5 concentrations for each color. Betweenshades can be added by crayons of the same pigments or "Liquid Colotones", which are watercolors to be applied either by brush or airbrush. The plastic overlays and their pigments are water resistent.

The original purpose of the method was cheaper commercial reproduction, especially in color: engraver's time is expensive and corrections can be made more quickly on overlays than on original copy or in plates. The corrections themselves are easily correctable and do not damage the copy. The actual overlays can be used as separation negatives for zinc plates. Corrected copy can be reproduced by photo-engraving, -lithography or -gravure.

By-functions of the method hold more immediate interest for the biophotographer. Transopaque can be used for retouching the negative, especially over large areas. Gray soltones furnish contrast control on the negative. On positive material being copied, whether drawings or photographs, gray solotones, cleared of pigment over an area which is to be accented, subdue the background of the final copy by darkening; or they can be used to accent the point of emphasis. White solotones over the background or any desired part of a positive make that part faint and ghostly in the original or copy. They are a handy method for "phantoms". Colotones build up a color picture from graphic or photographic B&W material, correct color transparencies for projection or reproduction and add color directly to lantern slides, roentgen films or posters.

The methods offer highly individualized solutions for some of the problems of the medical exhibit. Among the obvious applications are posters, signs, phantoms and diagrams in hinged layers.

The writer has been unable to find articles on the methods other than advertising material furnished by the maker, Bourges, Inc., 106 Fifth Ave., New York City. — John Fallon

Suggestions for Contributors

Manuscripts should be sent to The Editor, Journal of the Biological Photographic Association, 70 Alton Road, Stamford, Conn.

Manuscripts must be typewritten, double or triple spaced, with full margins. The original and not a carbon copy should be submitted.

References: References may be given as footnotes or, if numerous, may follow the context. They should be given in the following forms:

Book—Valasek, J. 1949. *Introduction to theoretical and experimental optics.* John Wiley & Sons, N. Y. x+454 pp.

Journal Article—Carman, P. D. 1949. Photogrammetric errors from Camera lens decentering. J. Opt. Soc. Am. 39(11):951-954.

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When mounted, illustrations should be twice or three times the page width which is 29 picas, or 4-5/6 inches. Illustrations for the cover should be multiple of 39 picas, or 6.5 inches.

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Reginald Johnson

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The Selection and Uses of Cine Lenses in Medical Motion Picture Photography

HARRIS B. TUTTLE, F.B.P.A.*

ONE of the most important considerations in making medical motion pictures is the proper coverage of the surgical or clinical field. It is important to the doctor or surgeon to be able to see in the projected motion picture all of the detail he was able to see in viewing the patient from his normal working distance.

It therefore becomes important for the person making medical motion pictures to learn from the doctor just how much of any area is required to obtain a satisfactory medical record of any given subject.

The lenses regularly supplied with 16mm movie cameras cover an angle closely approximating that covered by the human eye. The 1-inch focal-length lens (25mm) supplied as the standard lens on 16mm cameras covers a horizontal angle of 21.5° and a vertical angle of 16.2°.

While the angle of critical human vision is about 5 to 7°, the angle of conscious vision is about 25°.

Lens Coverage

In most cases, cine lenses covering areas varying from 5° to 30° in their angle of view reproduce areas comparable to what is normally seen by the eye. When lenses covering less than 5° are used, it is often evident in the projected picture, because the subject appears unnaturally close and both subject and background appear enlarged. When extremely wide-angle lenses are used, some objects, particularly those close to the camera, often appear distorted because the distant objects are not enlarged on the film in the same proportion.

In still-picture photography, the standard camera lens covers a greater number of degrees than lenses used on movie cameras. This is because in viewing a still picture, the eye can leisurely scan the whole picture from one side to the other. In motion pictures the action in the picture directs the attention of the eye to a smaller angle and the eye doesn't have time to scan the picture except in the case of scenics or other scenes where there is no action in the picture. The use of a narrower angle lens in motion pictures may therefore add to the realism of the picture and make it easier for the audience to follow the focal point of interest. The wide-angle lenses used on cine cameras actually cover a narrower angle than is covered by standard lenses on still cameras.

* Eastman Kodak Co., Rochester 4, N.Y. Received for publication March 5, 1951.

The photographic lens has often been referred to as the bottle-neck of picture making. This it literally true, because the size of the opening of the lens controls the amount of light that can be transmitted to the sensitive photographic film. It's easy to make a wide-mouth bottle through which more liquid can be poured, but it's not so easy to make a larger aperture or wide-mouthed lens to transmit more light and still maintain a first-class image.

Lens Specifications

Good photography demands that the image formed by the lens be sharp and clear and that small details be well defined. Further, the image formed should have a definite proportionate relationship to the subject photographed. There should be no distortion of the image vertically or horizontally. The lens should have high speed; in other words, the ability to transmit the greatest possible amount of light to form the photographic image. This is particularly important when filming in dimly lighted areas or at low light levels. It should be free from lens flare, neutral in color transmission, accurately calibrated for both aperture and focus, and so designed that it can be used to focus on objects close to the camera.

Scientists all over the world have spent a lifetime trying to improve materials and methods for lens design. Every decade has brought some improvement to photographic lenses.

Cine Ektar Lens

Before the first World War, most of the improvements in photographic lenses came from European countries, and many of the older generation in America still believe that the best lenses are of European design and manufacture. This is no longer true, for between World Wars I and II American enterprise and research mad up for their late start; so, today many of the best photographic lenses are made in the U.S.A.

During the past ten years, new types of optical glass were developed in the Kodak Research Laboratories which greatly extended the range of lens design. During the same period, considerable work went forward on the surface coating of lenses to reduce lens flare and increase light transmission. Also, improvements were made in the design of lens diaphragms and in lens mountings. As a result of these many findings and improvements, the Eastman Kodak Company introduced a whole new series of Cine Ektar Lenses for use on 16mm motion picture cameras, figure 1A.

These lenses have exceptionally high speed (in relation to their focal lengths), all of the series are coated to reduce lens flare, and all are mounted in new aluminum mounts which are extremely light in weight and well baffled, figure 1C.

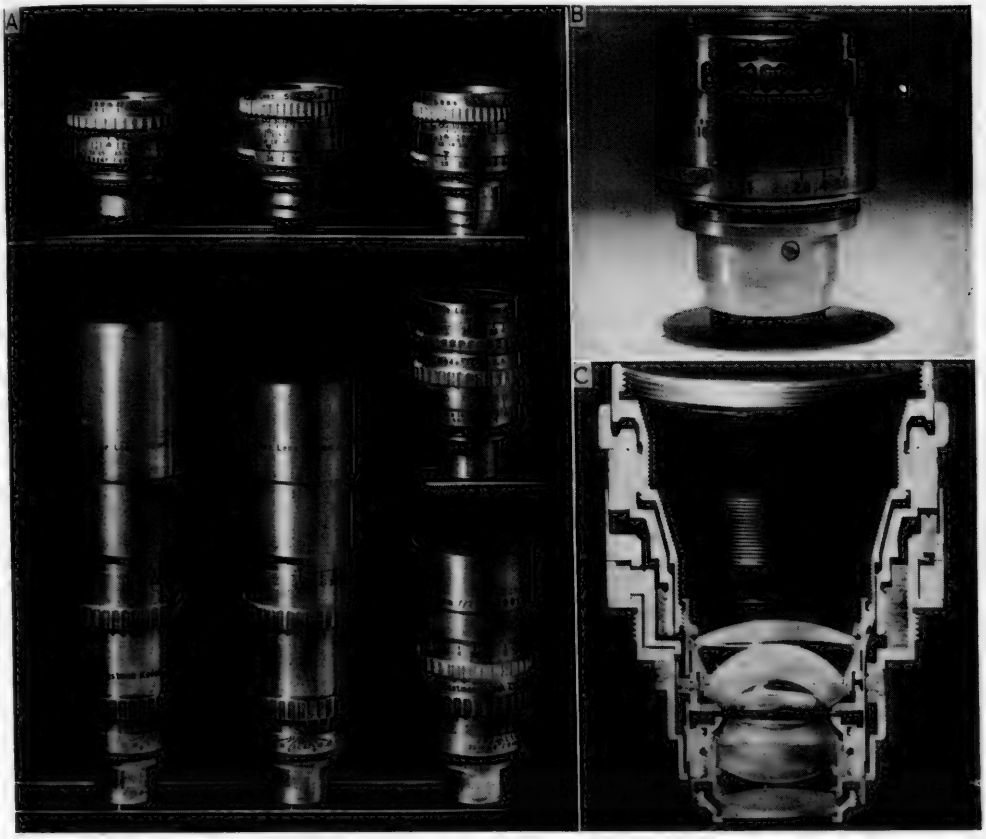

Figure 1. A. The Cine Ektar lenses are available in focal lengths varying from 15mm to 152mm in uniform design of light weight. B. Section of Ektar lens mount showing construction and stray light baffling. C. Clearly visible markings on Ektar lenses with uniformly spaced diaphragm scale and depth of field scale.

The lenses are the first to be designed as an interchangeable group, all capable of producing the same photographic quality on the films. In other words, the various lenses can be interchanged during the filming of a sequence of scenes without affecting the uniformity of color quality, definition, and contrast between successive scenes.

These lenses have many other important features. For example, all of them contain a new type of diaphragm which permits the use of a uniformly spaced scale on the lens barrel, thus eliminating the small intervals usually present at the smaller apertures, figure 7C. This makes it easier to set the diaphragm accurately.

Each lens has a depth-of-field scale engraved on the lens so that the depth of field possible at each diaphragm opening at a given distance is readily available.

figure 7C. The markings are filled with yellow pigment to prevent confusion with the focusing scale. These scales are increasingly valuable since the large maximum apertures have limited the depth of field so that some attention must be given to accurate focusing if the best depth is wanted for any given subject.

The focusing scale of many of the lenses is greatly extended. For example, the 25mm f/1.4 lens focuses down to 12 inches. The scales have been designed with additional markings at more nearly equal intervals because equal displacements of the lens at any part of the focus scale give equal changes in resolution and thus equal changes in image quality. The new scales have been arranged so that at no place are the adjacent distance markings separated by more than the distance which corresponds to the total depth of field of the lens at f/8. Each increase in focal length in this new series of lenses produces a 57 per cent change in the linear size of the image of film.

In many respects these new lenses represent a major advance in the 16mm field. Four of the new lenses are f/2.0 or greater in aperture, thus greatly extending the range of movie filming, by making it possible to obtain satisfactory exposures under lighting conditions which were previously unsuitable for movie making.

On the lenses that can be focused below 2 feet, the remaining distances are indicated in inches, and the figures are filled with red pigment. The coloration serves not only as a warning to watch the depth of field, since it is more limited at short object distances, but also as a reminder that the figures indicate inches.

For the first time on cine lenses, the focus scales are calculated for object distances that are measured to the position of the film or film plane in the camera. This fact is indicated by the engraved words "from film" on the focus scale. All but the 15mm lenses are focused without rotation of the optics, hence the position of the focusing and diaphragm index is always convenient for setting. The 15mm lens is provided with two sets of aperture markings so that there will always be one that is handy.

The entire series of lenses requires only one size of filter mount (Series VI), and wherever possible the filters are placed so that the lens hood protects them from direct sunlight. Threaded filter mounts have been provided. All the lenses are coated or lumenized, and special precautions, such as corrugated surfaces, baffles, and edge blacking, have been taken to prevent flare light from reaching the film.

Changing Image Size

In motion picture photography, picture interest can be greatly increased by an occasional change in perspective or point of view from which the picture is made, and also a change of image size of the object of interest. This image size is usually

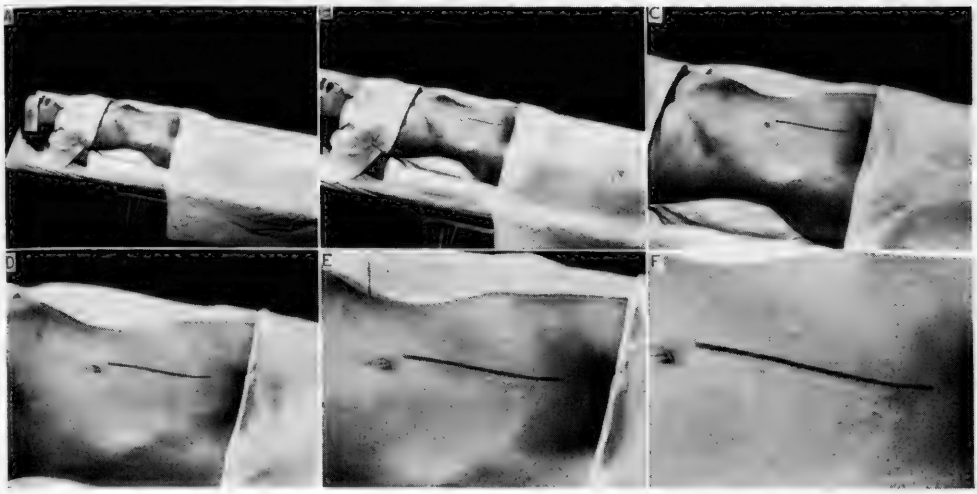

Figure 2. Use of interchangeable lenses in 16 millimeter cinematography of surgery. Simulated setup to demonstrate fields of view obtainable with Cine-Kodak Special Camera with A. 15mm, B. 25mm, C. 40mm, D. 63mm, E. 102, and E. 152mm lenses. The camera was ten feet from the subject; the "patient's" height was 60 inches; the "incision" was 5 inches long.

referred to as "long-shot," "close-up," or "semi-close-up." This can be achieved either by a change of camera position or by use of a longer focal length lens. In medical photography, we are primarily concerned with semi-close-ups and close-ups.

The longshot includes an area sufficient to acquaint the audience with the locale. The semi-close-up directs attention to the object or objects of chief interest. The close-up directs attention to a part of the object of interest wherein some detail contributes to the telling of a story. On most patients, the longshot might only show part of the anatomy where the incision is to be made. This point can be indicated by drawing a line on the skin with iodine. The semi-close-up would show this area being draped and the close-up would cover only the surgical field, figure 2.

In still photography, a larger image size can be obtained by enlarging a portion of the negative containing the picture image. In making motion pictures on 16mm film, this technique is not practical and the enlarged image must be obtained on the film. This can be accomplished in one of two ways. First, by the use of a longer focal-length lens, and photographing the object from the same point of view; or secondly, by the use of the normal focal-length lens and choosing a position closer to the object, where the desired image size can be obtained. It is usually more practical in motion picture work, particularly in medical motion pictures, to obtain enlarged images on the film by use of longer focal-

length lenses than by changing the camera distance. However, with fixed-lens cameras, an enlarged image on the film can be obtained only by using the camera closer to the subject.

When a short-focus lens is replaced by one of long focus, the same degree of enlargement is obtained of distant as well as near-by objects. When standard lenses are used and the camera is moved closer to the principal object to obtain an enlarged image of it, there it little or no apparent change in the size of distant objects. This is not important in medical movies.

For example, if an object in a scene were 10 feet from the camera and it was desirable to obtain a larger image size on the film, the camera could be moved up to five feet from the subject and the image size of the object would be increased by a factor of two times. If the object was one foot in width it would cover one quarter of the picture aperture at 10 feet and one half the aperture at five feet. However, it would be difficult to detect any difference in image size of objects at infinity. This second procedure, then, has resulted in enlarging near objects without materially altering the image size of distant objects.

The image size obtained with lenses of the various focal lengths is in direct ratio to the size produced with the standard lens. For example, if an image of certain size is obtained with the one-inch lens used on 16mm cameras, a lens of two-inch focal length produces an image twice the size, and covers about one-half the angle or number of degrees. A lens of three-inch focal length gives an image three times the size; a four-inch lens, four times; and a six-inch lens, six times the size, Table I.

TABLE I. Field Angles for 16mm Cine Kodak Lenses

Name	C.E.f/2.5 K.A.f/2.7 15mm	C.E.f/1.4 K.A.f/1.9 25mm	C.E.f/1.6 40mm	K.A.f/1.6 and f/3.5 50mm	C.E.f/2.0 K.A.f/2.7 63mm	C.E.f/2.7 K.A.f/2.7 102mm	C.E.f/4.0 K.A.f/4.5 152mm
			Focusing Mount				
Angular Field at Inf.	34.0° x 25.7°	21.5° x 16.2°	13.7° x 10.3°	10.8° x 8.1°	8.7° x 6.5°	5.4° x 4.1°	3.6° x 2.7°
Relative Magnification	.6X	1X	1.6X	2X	2.5X	4X	6X

C.E. — Kodak Cine Ektar Lens.

K.A. — Kodak Anastigmat, or Kodak Cine Ektanon Lens.

The series of pictures in figure 2 illustrates the fields covered by the various focal length Cine Ektar lenses when the camera is placed at fixed distance of 10

feet from the subject. No. 2A shows the area covered by the 15mm wide angle lens, B, the standard 25mm (1inch) lens, C, the 40mm, D, the 63mm, E, the 102mm, and F, the 150mm (6-inch) lens.

Assuming that 4 to 6 feet is a safe working distance, it can be seen that the 25, 40, and 63mm will be satisfactory for a majority of operations.

In filming clinical and gross specimens, the standard 25mm lens will be satisfactory in a majority of cases. Here again there will be occasional instances when the wide angle and 40 or 63mm lenses may be required.

Use of Wide-Angle Lenses

In some cases it may be desirable to include an area larger than is normally included by lenses of standard focal length. This can be accomplished by use of a wide-angle lens. The focal length of such lenses usually approximates the diagonal dimension of the picture aperture.

Bearing in mind that from a fixed camera position the image on the film will be in direct proportion to the focal length of the lens used, the medical photographer will find it advantageous to have a number of lenses of different focal lengths to meet the range of circumstances normally encountered in motion picture work. 1. When pictures are made in small rooms or otherwise cramped quarters, wherein it is desirable to include an area larger than can be covered by the standard lens. 2. When it is necessary to include a larger area in the picture, but undesirable or impractical to move the camera farther away from the subject.

Use of Long-Focus Lenses

When it is desirable to obtain larger images on the film than could be obtained with the standard lens without placing the camera closer to the subject, long-focus lenses should be used. Such conditions do exist in filming small areas of the body, particularly in surgery where the camera must be kept at a safe distance for asceptic reasons. It is also applicable to nature photography in filming insects, and animals which must be filmed from a distance. The choice of focal lengths will depend entirely upon the requirements of the user. The naturalist filming birds and animal life or the medical photographer will probably require a complete set of long focus lenses to meet all picture-making situations.

Holding The Camera Steady

The use of a wide-angle or short focal-length lens tends to minimize slight camera movements. The use of a long-focus lens accentuates all movements. Most users of movie cameras find it difficult to hold cameras equipped with standard lenses still enough during photography. It is therefore expecting a lot from the average worker to assume he can hold a camera steady when a long-focus lens is

used. Generally, the best picture results will be obtained when all shots are made with the camera on a tripod.

Lens Aperture and Depth of Field

One of the important factors which must be considered in using long focal-length lenses is that such lenses do not have as great a depth of field as standard lenses when used from the same subject-to-film distance. (Depth of field is often erroneously referred to as depth of focus.) This means that, in order to obtain the depth of field required, such lenses must be stopped down and used at apertures which will produce the desired depth. This can be accomplished by using more lamps to illuminate the subject when filming is done indoors. For the same image size on the film with different long focus lenses, the depth of field is the same.

Selection of Lens and Working Distance

It is sometimes desirable to determine quickly object and image relationships, so that the correct focal length of lens can be selected without loss of time. Let us assume that an image height of approximately 6mm (1/50 of a foot) would be about right on 16mm film to utilize the full screen height in the projected picture. If this is an image of an object one foot in height, the reduction in size is 50 to 1. Now, the ratio of the distance from lens to object and lens to image is the same as the size ratio, 50 to 1. Therefore, if our object is 50 feet away from the lens, the image will be one foot from the lens. In this case a lens of about 1-foot focal length would be required. However, there is no (1-foot) 12-inch lens available. The longest focal length available is 6 inches. Since the image size is proportional to the focal length, our image made with this lens will only be one half as high. To double the image size with the six-inch lens, it is necessary to move up to a distance of 25 feet to decrease the reduction to 1/25.

An example from the operating room, might require the surgical field to be 6 inches in height with a convenient camera distance of 75 inches. If our image height is to remain 6mm, the reduction which must be produced is 1/25. The distance from lens to film must be 1/25 or 75 inches or three inches which is approximately the focal length which must be used.

It will help considerably always to think of the usable image height, or full projected picture height, for example, as one fiftieth of a foot. Then, consider the object to be filmed in terms of its relation to this image height. For example, a man six feet tall is 300 times the image size. If the focal length of the lens available is one inch (25mm), the man must be 300 x 1 inch or 300 inches (25 feet) away to fill the full picture height on the screen. This line of reasoning will help

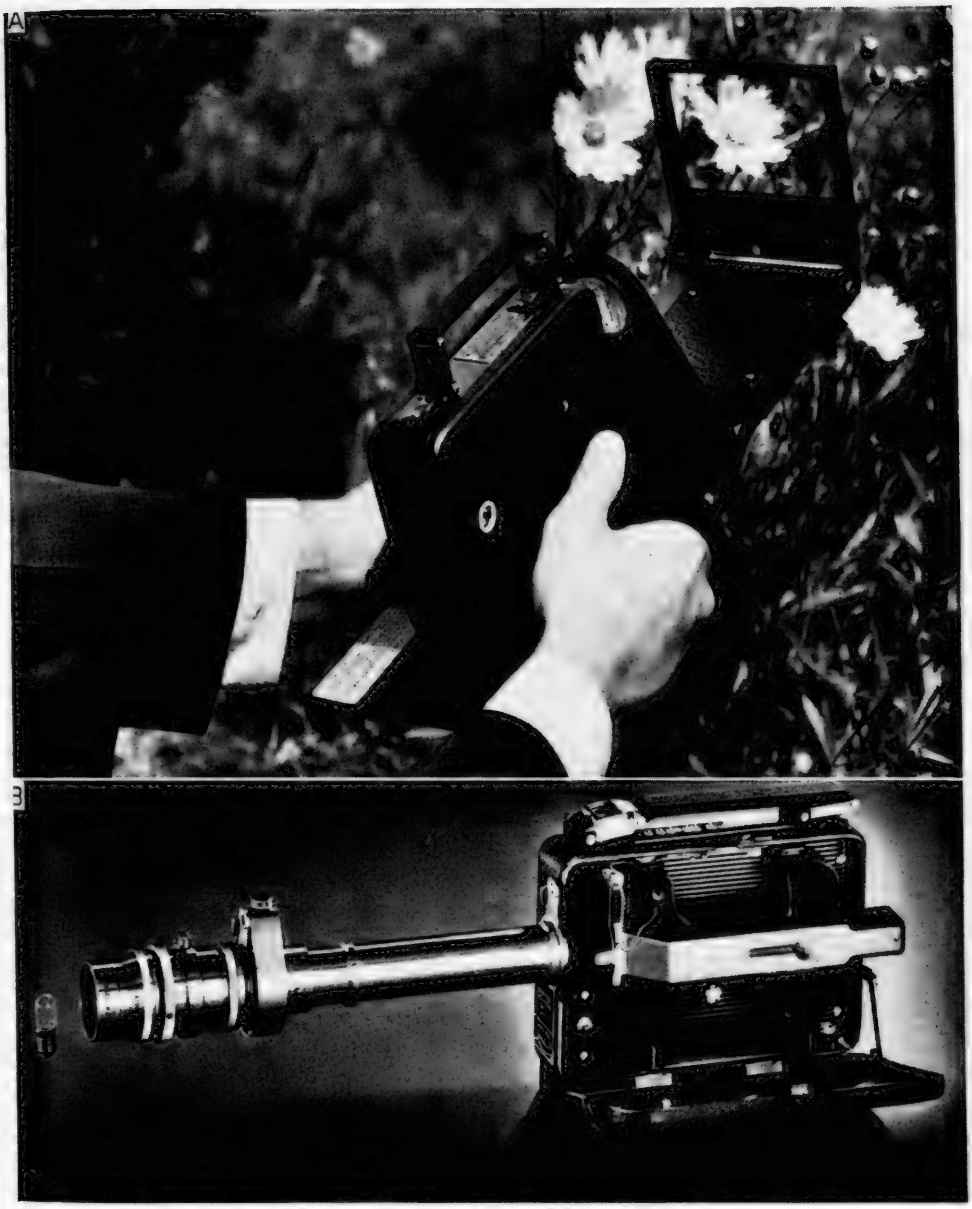

Figure 4. A. A movie titler can be used successfully to film small objects in extreme close-up, to copy maps, or titles, provided a supplementary portra lens is employed. B. Lens extension tubes permit extremely close focusing on very small objects and allow some degree of magnification; provided the camera is equipped for visual framing and focusing.

materially in selecting the range of focal lengths of lenses needed to do a specific type of filming, figure 3.

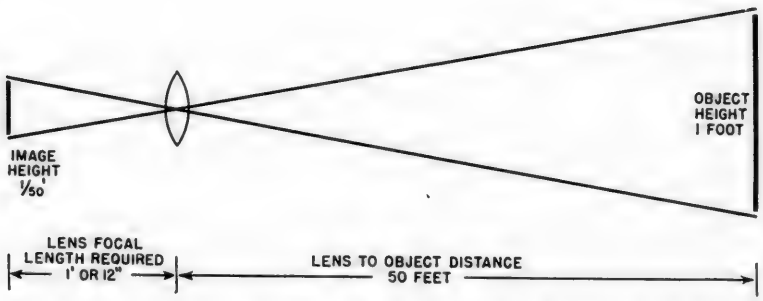

Figure 3. Relationship of focal length of lens to object size, distance and image size, as explained in text under "Selection of lens and working distance."

Supplementary Lenses for Small Object Photography

In addition to the lenses discussed above, the owner of either 16mm or 8mm equipment should have one or more supplementary Portra Lenses for extreme close-up photography. These are used in the filming of small objects placed close to the camera, and for copying maps, titles, and other such inserts usually required in the well-made motion picture.

The Cine Kodak Titler which is equipped with a supplementary lens can be used successfully in making a great many close-ups of small objects, figure 4A. In medical and dental photography this titler is particularly useful in making close-ups of fingers, ears, teeth, and other small areas.

Kodak Portra Lenses are available in suitable mounts for use with the various types of lenses. Such lenses enable one to focus on objects filmed close to the camera and which cannot be focused by the regular lens focusing scale. The standard 25mm and 13mm cine lenses in focusing mounts focus down to about 2 feet. The f/1.4 lens focuses down to 12 inches. The 15mm f/2.7 wide-angle lens focuses down to six inches.

In filming small objects with cameras which do not focus closer than two feet, the Portra Lenses can be employed. These lenses are available in 1+, 1¾+, 2+, 3+, and 3¾+ diopters. Tables available from Eastman Kodak Company show the size of field covered by each at different camera-to-subject distances and with the camera lens focused at different distance markings on the lens scale. *Diopter* indicates the power of the lens. A lens of one diopter has a focal length of one meter. The dioptric power of a lens is the reciprocal of its focal length when expressed in meters. Thus, a lens with a focal length of .1 meter or 100mm has a power of 10 diopters. When the camera lens is focused for infinity, the working distance of the Portra Lens is equal to its focal length.

Supplementary lenses of .75 diopters, 1, 1¾, 2.5, 3¾, and 5 diopters, have been found most useful in motion picture photography for average close-up work

when the object must be placed from 15 to 24 inches from the camera. Such lenses should be optically centered in a suitable mount for use with the standard camera lens. While supplementary lenses can be used with any type lens, they have been found most useful with lenses of standard focal lengths.

Use of Lens Extension Tubes

For extremely close-up work, where some degree of magnification may be required on the film, lens extension tubes are recommended. Since the use of extension tubes requires accurate framing and focusing, such equipment should be used only on cameras equipped for visual framing and focusing such as the Cine-Kodak Special or the Magazine Cine-Kodaks, equipped with Kodak Focusing Finder, figure 4B. *Subject distance* should be carefully measured, because the depth of field at small distances is often less than one inch. For sufficient depth, lighting conditions should be chosen so that the smaller lens apertures can be used. The subject distance is measured to the film plane when the camera lens is either a Kodak Cine Ektar Lens or a Kodak Cine Ektanon Lens having a focusing scale on which the words "from film" are engraved.

Film location for Cine-Kodak Cameras: Magazine 16 and 8mm — 1 1/16 inch back from the camera front, Model K — 13/16 inch back from the camera front, Special — ⅛ inch back from front edge of film chamber.

There is a lens or combination of lenses available for every type of subject. It is not a difficult task to select lens equipment suitable to meet individual needs. The lens normally supplied on all 16mm cameras will be satisfactory for a large percentage of subjects; however, the use of long-focus and other lenses will add greatly to the clarity and general quality of your medical films. The best solution to the choice of lenses is to make a series of tests from a good practical working distance. From the projected test, one can then choose the focal lengths of lens best suited for his requirements. The lens or lenses most frequently used can be left on the camera all of the time.

In talking with a number of workers who devote considerable time to surgical motion pictures of all types of operations, it would seem that the 40mm and 63mm lenses are used most frequently. However, in filming patients before or after operations and other clinical work, all of the different focal length of lenses are used at some time or other. If the budget will only stand for two or three lenses, I would choose the standard 25mm, the 40mm, and the 63mm. Perhaps 80 to 90% of the average filming to be done can be handled by these three focal lengths.

Once the medical photographer has a good working knowledge of the field sizes covered for any given operation, it is an easy matter to determine in advance the various focal length lenses required for a given job.

Filing and Classification Methods of Photographic and Illustrative Material

(Continued)

MARGARET SCHELL*

Part II — Simple systems applicable to classification of medical material.

There are a number of commercial filing systems which may be easily adapted to medical material. One of the excellent reference books on major filing methods is Margaret A. Odell and Earl P. Strong's book: *Records Management and Filing Operations.*[5] Some of the guides employed commercially are: name, location, subject; date; number; department; territories-customer; commodity, or classification. Filing systems may fall roughly into the following categories: *alphabetic:* surnames and first names of individuals; names of organization and locations both geographic and political; months and days (chronologic-alphabetic-numeric); *numeric:* consecutive numeric, duplex numeric; decimal numeric; code numeric; skip numeric and terminal digit-numeric, and *chronological.*

The photographer confronted with the necessity of keeping records of his slides, photographs and films as well as retaining and filing all negatives and making trial sample, or duplicate photographs, bases his choice of filing and classification arrangements on several factors. The production or amount of his material must be considered, the requirements of the institution he is affiliated with and finally two of the most important ones: space and funds available.

First of all then, the photographer should have a negative file which may be arranged chronologically and numerically. It consists usually of envelopes with date and number of photograph, patient or client photographed, diagnosis or purpose of photograph (publicity, lecture, research, record, medico-legal or other). Often this is accompanied by a brief patient's history. In addition to these chronologically filed negative envelopes it is often desirable to keep a subject card index or two and a notebook for daily consecutive entries.

The daily entry book may contain the identifying chronological number, patient's name, attending doctor, diagnosis, and kind of research or visual education material (kodachrome, black and white slide, drawing), photograph made and/or available on this particular subject. Dr. for drawing, S for slide, K for kodachrome are common abbreviations in such a book.

A medical records librarian would be likely to cross index a collection of negatives and research material several times over: by name of patient, kind of operation, medical diagnoses and perhaps have a physician's index besides. A medical museum librarian might use a diagnosis plus an anatomical location

system and alphabetical system indexes such as a grouping under Bacteriology; Ear, Eye, Nose, and Throat; Female Reproductive and Fetal Tissues; Gastro-Intestinal System, etc. The photographer, however, seldom has, or will take the time to do much classifying.

Subject or disease files may be easily grouped alphabetically, once by disease, and if desired, once more by organ or tissues affected. Sub-classifications especially among the tumors, presuppose a knowledge of histology and pathology but a consultation with the doctor or quick reference to a medical textbook, especially those on pathology, usually solves the average problem. The front or back page indexes of these textbooks are excellent guide posts for setting up index systems. The only trouble is, there are too many varieties of them.

Duplicate photographs for teaching, lectures, papers or other references may be arranged either in envelopes marked on the top margin and filed in vertical files, or mounted on cards or paper sheets with the caption typewritten on the top. They may be filed alphabetically or by systems such as mycology, hematology, bone and joint diseases, nervous system, etc. Each photograph should be marked or labeled with case number, diagnosis and date taken.

Breakdowns within the alphabet may be done in 4's, 5's or 6's divisions, as for instance Carcinoma A-D, E-G, etc. (carcinoma of esophagus falling within the E-G group) or broken down into carcinoma-kidney; carcinoma-lung, etc. divisions. The same may be done with any other disease entity or whenever one unit becomes too bulky.

For a large photography department it may be necessary to install a departmental or doctor's file which is frequently a part of a medical record librarian's set of files. Departmental designations such as Obstetrics and Gynecology, Surgery, Dermatology, etc. would probably be more practical designations being more permanent and stationary than individuals' names.

Authorizations or permits to photograph a live patient are usually filed under patients' names and obtained either by photographer or attending physician.

Whenever doubt exists as to the proper classification of a given unit, consider frequency, importance and volume of the material to be classified. Several classifying systems may be used efficiently and harmoniously within one group. The American College of Surgeons' Library in Chicago is a fine example of such a procedure. The kind of system used is secondary in importance to efficiency, simplicity and ease in locating the desired material.

Where space and budget permit, a centralized department for storage, loan, exhibit or demonstration of photographic and illustrative and related research material may be set up as a separate unit. Such a department could be maintained under the jurisdiction of the Pathology department, the same as many photo-

graphic departments generally are. A Museum of Pathology containing slides, photographs, pathological records individually and in collections which are loaned out for display, exhibits, research, lectures, teaching and other purpose and which may well include films and other illustrative material, has been described in a previous paper.[14] This proposed department has many useful functions and would appear to be ideal for the efficient integration of photographic research and teaching material of all kinds, used singly or in conjunction with cardiology, roentgenology and other exhibits. In this manner, the skilled photographer whom every modern and progressive hospital or medical school should have, may concentrate on the various phases of photographic work without the necessity of devising and organizing numerous filing systems other than just a few simple and indispensable ones. At the same time, extensive and varied informative and educational material is made easily accessible to anyone desiring such material. Such a centralized Museum of Pathology or Medical Museum may be operated effectively by just one librarian and very much like specialized, small libraries operate at present.

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I wish to express my appreciation for courtesies extended to me by John Crerar Medical Library; Archibald Church Library, Northwestern University Medical School and by the Photography, Medical Record and Administrative departments and Staff Members of the following Institutions: University of Chicago; Northwestern University Department of Pathology; University of Illinois; Loyola University; Wesley Hospital; Augustana Hospital; Grant Hospital; American Hospital; Martha Washington Hospital; Columbus Hospital; Mercy Hospital; St. Francis Hospital; Illinois Children's Hospital School; Children's Memorial Hospital; Barnes Hospital, St. Louis; Evanston Hospital, Evanston.

A Micro-Slating Device

ARTHUR L. SMITH*

IN the production of motion pictures the importance of adequately slating each scene is well recognized. This identification becomes the principal key in organizing rushes, selecting the best footage, assembling the work print, and in the final cutting. The slate and the accompanying camera log sheet usually comprise the only specific record of accumulated footage.

The cameraman operating a photocinemicrographic apparatus cannot employ the usual methods of scene identification except by the laborious process of shifting to conventional photography for each slate. Although edge numbering of negative stock provides the usual aid in the editing stage, the original exposures through the microscope can often be easily confused as to absolute identification unless a means is provided to place the customary information of a standard slate at the beginning (or end) of each exposure. Since the presumed ideal form of identification will consist of a frame-sized image of pertinent data, the micro-

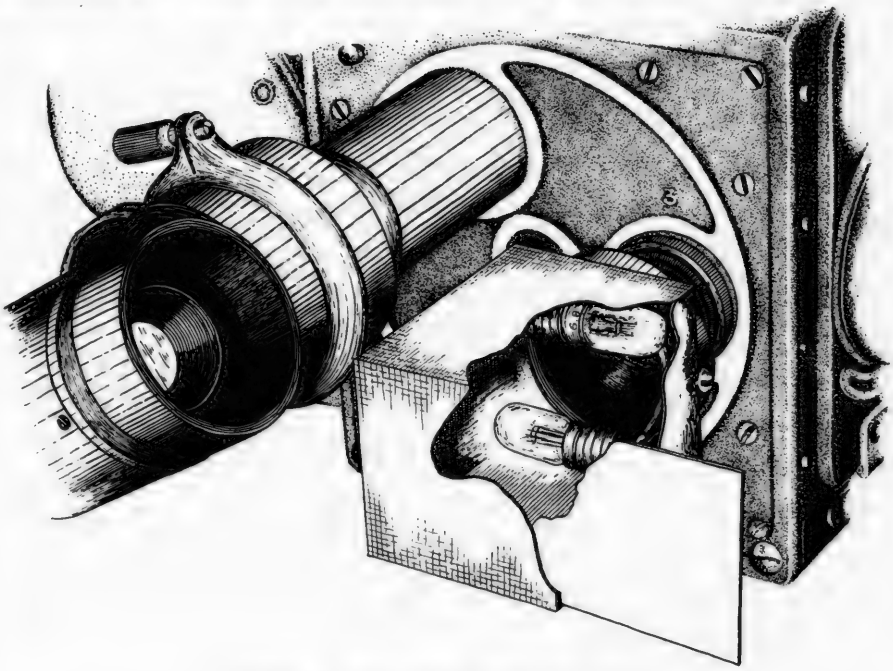

Figure 1. Micro-slating device on camera.

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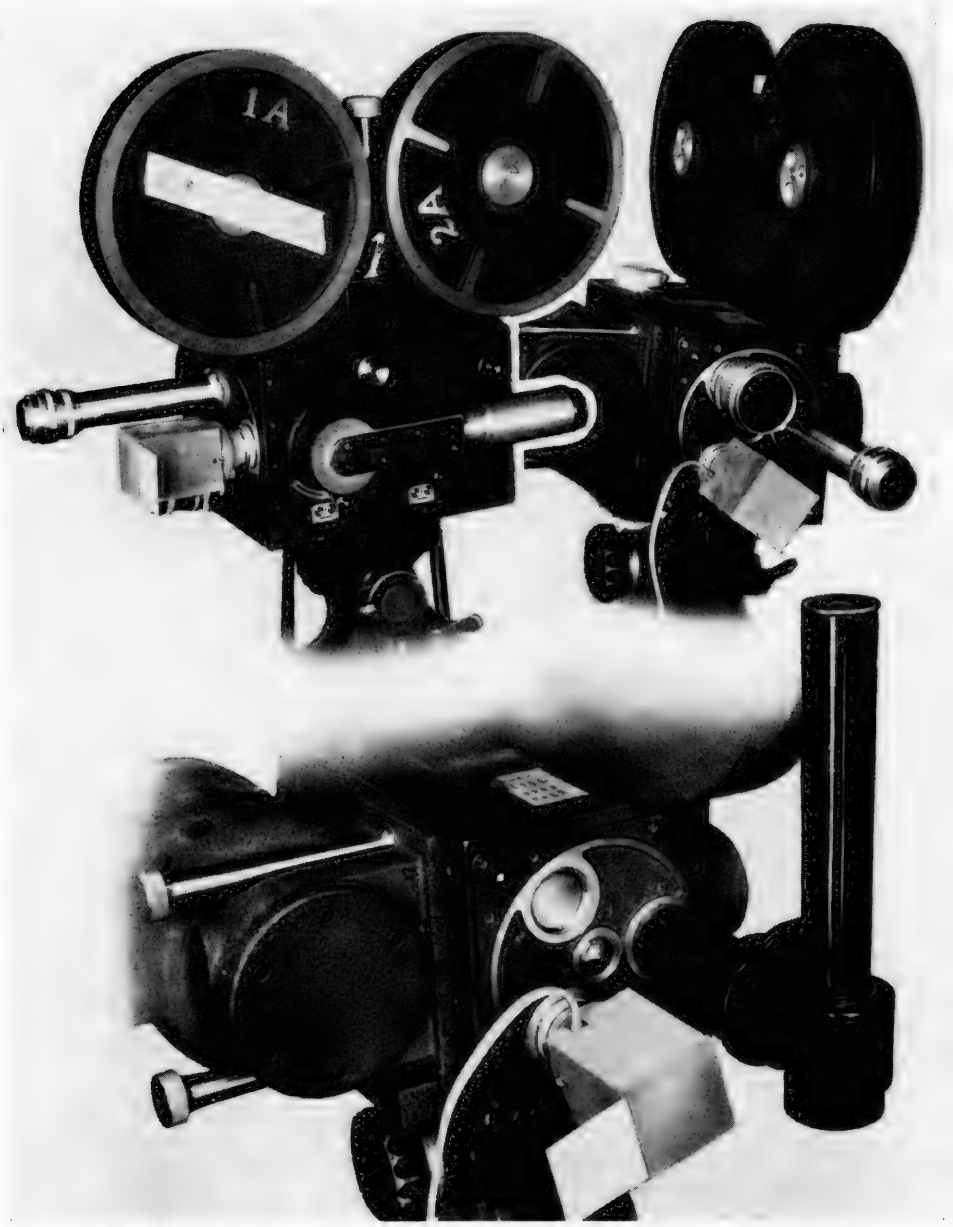


Figure 2. Micro-slating box shown with extension tube and beam splitter.

slating device to be described was constructed in such a manner as to accomplish this purpose.

To those individuals familiar with the somewhat cramped area involved in a photocinemicrography apparatus, it will be apparent that any added equipment must be somewhat miniature in size and should not interfere with the normal operation. Specifically, the design requirements consisted of (1) the smallest slate size which would permit typing or hand lettering the necessary data, (2) the use of a very short focal length lens to minimize subject distance, and (3) a system of illumination in which the brilliance could be varied to suit the particular speed of the film being employed. In addition to these basic specifications, it was also essential that the device be adaptable to two different cameras being used — the 16mm Maurer Professional and the Eastman Ciné Special.

By the use of a movable ruled target and the substitution of various existing lenses, it was determined that a 1⅓ x 1½ inch "slate" located 3 inches from the front of the camera and 3⅞ inches from the film plane could be brought into full frame focus with a 16mm Micro Tessar objective. This 16mm objective, designed for photomicrographic use, had a fixed aperture of f4.5, but inasmuch as virtually no depth of field was necessary, this was not a handicap.

A small rectangular box was constructed of 40/1000 brass shim stock. Its overall dimensions of 2¼″ x 1½″ x 1½″ could be accommodated without interfering with either the Bausch and Lomb beam splitter or the lower power extension tubes, figure 2. A slot at one end of this box permitted the insertion of the micro-slate. The other end was fastened by two adjustable screw positions to a brass block which in turn was attached to a series of flanges for adapting the device to the lens. The entire assembly, shown in figure 1 was then connected by a further flange to a spare turret port.

Illumination was provided by two small double contact 6.8 V panel lamps. The screw type sockets necessary for these lamps were soldered to the brass attachment block outside the angle of lens coverage. Due to the fact that the lamp filament could not be laterally centered, the sockets were faced in opposite directions, resulting in a reasonably balanced illumination. Lamp intensity was controlled by a small rheostat operating from a 10-volt transformer. Proper

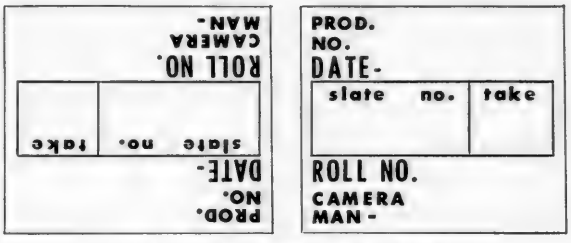


Figure 3. Slate card full size.

markings were placed on the dial plate to indicate the voltage setting for each of three films—fast reversible, negative and color stock.

In use, the lens turret, with micro-slate attached, is rotated into position, the slate card inserted, the lamp intensity properly adjusted and the exposure made. All essential information may be either hand written or typed in the allowable slate area. An actual size typical micro-slate card is shown in figure 3. Since the focus is pre-set, the operation of the device has proved to be both simple and efficient, producing a clear, sharp, properly exposed, full frame slate image.

It may be seen that the principle of the micro-slating device is very simple and in many ways similar to certain amateur titling attachments. It is perhaps original in its size and with respect to its built-in illumination. There seems to be no reason why it could not be adapted to any 16mm or 35mm motion picture camera providing the proper connecting flange could be secured. Although the intended use of the micro-slating device was specifically for photo-cinemicrography, it is also interesting to consider its possible use for conventional slating. Since the instrument would monopolize one of the turret ports, this might be considered as a disadvantage. Cameras having three or more turret ports might overcome this objection. The existence of conventional slating practices might also occasion a resistance to its use. Nevertheless, the film editorial advantages might warrant a thorough trial in standard scale productions.

Association News

Mr. Robert D. MacIntyre formerly associated with the University of Houston has joined the Medical Illustration Laboratory staff at the Veterans Administration Center, Temple, Texas.

Mr. George G. Lower, Westtown, Pa., tells in the summer *Leica Photography* (4(2):10-11, 41) how to photograph marine life and delightful color illustrations attest his methods.

Miss Margaret Markham's fundus pictures in the August *Journal* were made from Bantam Kodachrome Originals.

"Illustrations for publication" by Phillip A. Conrath, St. Louis, has appeared in the *Journal of the Missouri State Medical Association* June 1951, pp. 467-469.

Charles Lindsay, Chicago, is off to Scotland following the annual meeting.

H. Lou Gibson, Rochester, N.Y., glorified the insects in the August issue of Camera with pictures and advise on how to do it.

Member Rodger J. Ross, Ottawa, Canada, Supervisor of the Technical Research Department, National Film Board, is cooperating with a group of chemists headed by Dr. Charles G. Farmilo on a long range project directed toward the development of methods for the microchemical identification of narcotics. A paper recently published in the United Nations Narcotics Bulletin entitled "Microchemical Identification of Synthetic Narcotics" contains reproductions of 27 photomicrographs made by Mr. Ross. One of Ross' color photomicrographs of a narcotics crystal formation made on Ansco Color Film with a Spencer Phase microscope was selected by the Royal Photographic Society for its 1950 technical and scientific exhibit.

To All Members of the Biological Photographic Association:

Our Finance Committee is active. Dr. Farris, Chairman, has reported two substantial contributions and Mr. Harris B. Tuttle has accepted the Chairmanship for a Membership drive. I urge all members to help in the following program for a successful drive so that we can have a better *BPA.*

OSCAR W. RICHARDS, *President*

Membership Committee Drive Program:

As many B.P.A. members already know, the society has had some very tough sledding during the past two or three years. 1. All costs connected with the various offices of the society have risen sharply. 2. The cost of printing and quarterly issues of the Journal have also more than doubled in the past few years. 3. There has been no money available for improvement of the Journal or to provide other services for our members.

Briefly, the society must increase its income if we are to continue to operate and publish a Journal and build firmly for the future.

The officers of B.P.A. have considered it unwise to raise our membership dues. Since we have approximately 750 members, a raise of even $2.00 a year in dues would yield only $1500 in new income which would not begin to produce the amount of new income needed.

The B.P.A. finance committee headed by Dr. Edmond Farris, Director of Wistar Institute, Philadelphia, Pa., has made a careful study of the problems and in the committee's report at the recent Convention in Boston, recommended several ways of increasing the society's income.

1. To urge all present members who can afford to do so to become contributing members. Any amount over and above the normal membership

dues will be acceptable and most welcome. Each member is urged to estimate the amount that he can contribute on a yearly basis. For example, it would be unwise to give $10.00 this year and nothing for the next five years. It would help the society in its budgeting to have $2.00 each year for the next five years. Whatever the amount that can be contributed, it should be a sum that can be repeated each year.

2. To conduct a general membership campaign to increase the membership in the society of persons who are actively engaged in Biological, Medical, Scientific and Nature and fields closely associated with the interests of our society.

This means that each and every member of the society must get as many new members as possible from among their friends and associates.

In order to accomplish this every member of the society must be on the membership committee. This is a very serious situation. It is your society. Its future depends upon every member putting his shoulder to the wheel and giving a push during this coming year.

3. To conduct a drive among the medical profession for $10.00 Contributing Memberships in the society. We believe that there are many Doctors who are continually using photography in their work and who have profited immeasurably through the work done, and new techniques developed by B.P.A. Members. Many of these Doctors will welcome an opportunity to help support and extend the organized work of our society.

4. To conduct a drive for Contributing Memberships among the Companies Manufacturing or Distributing Materials and equipment used in the Medical and Biological Sciences.

In order to carry out this new membership drive program, the Board has asked Harris B. Tuttle, F.B.P.A., 343 State St., Rochester 4, New York, to act as Chairman of the Membership Drive Committee. Harris has accepted and every B.P.A. member should lend his whole hearted support and cooperation to Harris during the coming year. All members will receive instructions from him in the near future.

In the meantime you can help get started right away by doing the following:

1. Determine whether or not you can become a contributing member. If you can, send your contribution to the treasurer today.

2. Make out a list of all persons you can think of in your city whom you consider eligible for B.P.A. Membership.

3. Get a supply of membership blanks from the Secretary and start signing up as many new members as you can. Send these applications and

checks to Harris Tuttle, so he can keep track of the progress and number of new members obtained.

4. Contact your local public library and see if you can't get them to join in order to receive copies of the B.P.A. Journal for library use.

5. Make out a list of Manufacturers and Distributors in your city who supply materials and equipment for use in the Medical and Biological sciences. Send this list to Harris Tuttle.

6. Make out a list of all the Doctors and their addresses in your hospital or medical school who are using or have used photography in anyway during the past several years. Send this list of Doctors' names and addresses to Harris Tuttle.

7. We would like to have each chapter conduct a membership drive contacting all of the persons on their mailing list. Warren Sturgis, chairman of chapters, will write to the chapter secretaries about this.

Items 1, 2, 3, 4, and 7 you can do directly as a member of the Membership Committee. However, it's very important that you supply Harris Tuttle with all the names you can as requested in items 5 and 6.

Remember this is your Association and your Journal, it's up to each one of us to do our part. If we can double our membership during the next year it would be almost equivalent in income to doubling our membership dues. With more members the cost of printing the Journal will be reduced and other services to our members can be provided.

Let's all get on the band wagon and work together to boost B.P.A. and our membership during the next year.

Please tear out and mail today

B.P.A. Contributing Membership Application

Enclosed please find my check or money order for $_____ for my contributing membership in the Biological Photographic Association for the year 1952.

Please bill me each year for a renewal of the amount.

Name _____

Street _____

City _____Zone _____

State _____

Under-water Life Films Needed

Avis Gregersen writes that the Walt Disney Studios need photomicrography in color of under-water life on 16 mm film. If you have any please write to Miss Wanda Elwin, Walt Disney Studios, 2400 Alameda Street, Burbank, Calif. She adds: "I would love to have some one of our group be able to help them. Did any of you see 'Nature's Half Acre?' Our BPA members [Southern California Chapter] helped to a great extent to create that wonderful strip of film and even the name of our member was stated at the beginning of the film — Tilden Roberts. You folks saw his film last year 'From Egg to Butterfly' and it was well received you remember."

Transopaque, Solotone and Colotone

The following references were received from Dr. John Fallon to be added to his note in the August issue of our *Journal* (pp. 143-144) just too late for inclusion in that issue: Albert, M. H. 1948. Retouching without touching. Phot. Age, 3:8-9 (May). Bourges, A. R. 1947. Correcting color transparencies without retouching transparencies or extra photography. Photo Engravers Bull. 37:211-215 (Nov).

Back Issues Needed

No copies are in stock of the following issues of our Journal: volume 4 numbers 2 and 3, volume 5 numbers 1 and 3, volume 8 number 2, volume 9 number 1 and volume 11 number 1. Copies of these are needed for libraries here and abroad wishing to obtain or complete their files. The Association could use extra copies of the following issues to complete sets: volume 2 numbers 1 and 3, volume 1 number 4, volume 3 number 3, volume 5 number 4, volume 10 number 1 and volume 12 number 1. Anyone knowing of available issues or willing to sell any of these issues is urged to communicate with the Editor, 70 Alton Road, Stamford, Conn.

BIOLOGICAL PHOTOGRAPHIC ASSOCIATION
21st ANNUAL MEETING

12 - 14 September 1951

HOTEL KENMORE — BOSTON, MASSACHUSETTS

PROGRAM

CRYSTAL BALLROOM

WEDNESDAY, 12 SEPTEMBER:

8:30 a.m. — REGISTRATION

10:00 a.m. — CALL TO ORDER

OSCAR W. RICHARDS, F.B.P.A., *President*

10:05 a.m. — WELCOME

FERDINAND R. HARDING, F.B.P.A., *Chairman,* Local Committee

10:15 a.m. — PRESIDENT'S REPORT AND BUSINESS MEETING

11:15 a.m. — MOTION PICTURES

12:15 a.m. — LUNCHEON

Address: "POLAROID DEVELOPMENTS IN BIOLOGICAL PHOTOGRAPHY"
R. T. KRIEBEL, Polaroid Corporation, Cambridge, Massachusetts

2:00 p.m. — "CARE AND UPKEEP OF CAMERAS"

The camera is a vital factor in the photographer's livelihood and should be handled with care in proportion to the value placed on results obtained with it as well as its intrinsic value. It must be kept clean, dry, closed, and out of the sun when not in use. Above all, it must be kept clean. Detailed instructions are given concerning how to clean and maintain Cameras without incurring damage.

C. E. BABCOCK, Bab's Photo Repair Shop, Boston, Massachusetts

2:25 p.m. — "CONSERVATIVE USE OF 35mm IN BIOLOGICAL PHOTOGRAPHY"

A presentation showing the versatility of the 35mm camera. A single subject, a species of butterfly, is used as an example. Starting with a view of the habitat and the lens focused at infinity, a series of closer range and microscopical studies in progressive steps of greater magnification is shown. Each study is followed by an illustration, showing the camera setup used.

JACK FASON, Medical Illustration Laboratory, Veterans' Administration Hospital, Denver, Colorado

2:50 p.m. — "PHOTOGRAPHY OF THE OCULAR FUNDI"

A description of what photography of the ocular fundi is; also, its scope and medical importance. The technical problems encountered in photographing through the media of the eye to record details in the retina and also in the choroid, vitreous, and other layers are discussed. The special equipment required, including the Zeiss-Nordenson and Bausch and Lomb retinal cameras, and the limitations of equipment in recording certain types of pathological conditions are described. A new technique for registering details not ordinarily visible with the ophthalmoscope or camera with standard methods is presented. Technical problems remaining for future solution are noted.

MARGARET MARKHAM, Department of Ophthalmology, New York University, Post-Graduate Medical School, New York, New York

3:15 p.m. — "MICROFILMING RADIOGRAPHS — THE PRESENT PROSPECTS"

An investigation of the feasibility and practicability of microfilming radiographs. The quality of photographic operations on a production basis can be observed more readily with the use of objective quality standards than by visual inspection of the product where no special targets suitable to the needs of special projects will be presented.

BRUCE F. DENMAN, Veterans' Administration, Record Center, Philadelphia, Pennsylvania

3:40 p.m. — "THE INTRAFLEX BODY CAVITY MOTION PICTURE CAMERA"

This 16mm motion picture camera is exceptionally well suited for photography of deep cavities and can be adapted to several types of standard endoscopes. In the Intraflex camera, the source of illumination is coaxial with the optical system so that a beam of collimated light is projected in coincidence with the camera's cone of vision. A transmission-reflection mirror in the optical axis reflects a portion of the image-forming light to the ground glass of a magnifying view-finder. Part of this presentation is in the form of a short demonstration film.

WARREN STURGIS, Sturgis-Grant Productions, Inc., New York, New York

4:05 p.m. — "SAFETY IN THE OPERATING ROOM"

A discussion of safety factors in the operating room as they affect medical photography.

ARTHUR HARRINGTON, Department of Public Health, Division of Hospital, Commonwealth of Massachusetts

4:30 p.m. — "SPEEDLIGHTS IN MEDICAL PHOTOGRAPHY"

Speedlights, or electronic flash equipment, are being used in many phases of medical photography to an ever increasing degree. Although many theoretical papers have been presented, describing such applications, concrete data concerning techniques and results have not been presented in a combined summation. This paper surveys the many uses of speedlights in hospitals throughout the country, along with samples of work and data concerning the techniques used. Material presented has been contributd by a large number of medical photographers, many of whom are B.P.A. members.

HARRY L. PARKER, American Speedlight Corporation, New York, New York

5:00 p.m. — SALON INSPECTION — Commercial Exhibits

7:30 p.m. — MOTION PICTURES

THURSDAY, 13 SEPTEMBER:

8:30 a.m. — SALON INSPECTION — Commercial Exhibits

9:30 a.m. — "CINEFLUOROGRAPHY"

Diagnostic applications and technical factors. A method of making X-ray motion pictures of joints and various other areas, including cerebral arteriography and angiocardiography. Recent developments in equipment are explained. The film shown includes slow-motion scenes and phases of optical printing.

SYDNEY A. WEINBERG, Strong Memorial Hospital, Rochester, New York

10:05 a.m. — MOTION PICTURES

11:30 a.m. — SALON INSPECTION — Commercial Exhibits

2:00 p.m. — "PAPER NEGATIVES AS AN AID IN SELECTING FIELDS IN PHOTOMICROPRAHPY"

A method is described for delineating areas of histological preparations to be photographed. A preliminary print is made on photostat paper, on which the investigator marks the desired area to be photographed. The final photograph can then be made in the absence of the investigator.

F. H. MEILLER, Pathological Technology Unit, National Cancer Institute, Bethesda, Maryland

2:15 p.m. — "PHOTOMICROGRAPHY OF CONSTANT AUTORADIOGRAMS"

In the course of an investigation of the deposition of radium salts in bone by means of an autoradiographic technique, the problem of recording and utilizing material so prepared presented itself. The necessity of maintaining absolute registry between the tissue sections and the nuclear tract plates posed many problems which made ordinary equipment and procedures impracticable. A procedure is described for making two negatives from a tissue autoradiogram in sequence, using a simple device placed in the film plane of the camera. The method of illumination, optical alignment, exposure calibration, and the determination of magnification factor are presented in detail. Particular emphasis is placed upon the method of maintaining a fixed magnification ratio.

PAUL N. WILKINSON, FRANK E. HOECKER, and PAUL G. ROOFE, Departments of Physics and Anatomy, University of Kansas, Lawrence, Kansas

2:40 p.m. — "IMPROVEMENT IN PRESENTATION OF MATERIAL WITH LANTERN SLIDES"

Several articles have recently been published on the preparation of effective lantern slides. Some technical organizations have been using these to emphasize the importance of the use of proper slides as aids to the presentation of good lectures and technical papers. Based on experience gained in the Calco Laboratories, a general discussion of lantern slides and their projection is given with illustrated examples.

CHARLES MARESH, LOUISE PESYK, and MARY LIB HUSELTON, Calco Chemical Division, American Cyanamid Company, Bound Brook, New Jersey

3:05 p.m. — "GREATER UTILIZATION OF TEACHING AID TRANSPARENCIES"

Institutions employing transparencies as teaching aids require adequate means of presentation when projection is not desired or possible. Several factors influencing the design of a suitable viewing device are discussed. A transparency illuminator to meet these needs is described and construction data are outlined. A suggestion is made for standardization of this or a similar design to encourage and facilitate the interchange of transparency material among interested groups.

VERLIN Y. YAMAMOTO, Medical Illustration Laboratory, Veterans' Administration Center, Des Moines, Iowa

3:20 p.m. — "STANDARDIZATION OF ANATOMICAL POSITIONS IN MEDICAL PHOTOGRAPHY"

In the interests of classifying similar types of lesions and demonstrating the results from various therapies, standardization of routine views is important. The relative positions of camera and lights to various anatomical landmarks are discussed and illustrated.

DENNIS A. STEVENS, Department of Medical Photography, New York Medical College, New York, New York

3:45 p.m. — "NEW POLARIZATION METHOD IN BIOLOGY AND MEDICINE"

A new method of color polarization in microcopy is discussed. Unstained frozen sections of tissues, small living transparent animals, botanical, zoological, and medical specimens without further preparation receive remarkable color differentiation. Artifacts and structural changes are avoided. This method does away with chemical alterations, staining, and dehydration, as well as saving valuable time and preserving the true histological picture of the body tissues. Illustrated by Kodachromes.

ROMAN VISHNIAC, New York, New York

4:10 p.m. — "PHOTOGRAPHY IN A FOOD RESEARCH LABORATORY"

A discussion of the role of the photographer in a food research laboratory, his value, his problems, and his work. Using poultry as an example, it is shown how studio photography, copy work, photomicrography, and other techniques enter into his work and how varied the subjects are. Photographs chosen to illustrate these points trace the development of a chicken through each day of incubation, its growth, and its preparation for the dinner table.

G. A. WERNER AND W. D. ROTH, Research Laboratories, Swift and Company, Chicago, Illinois

4:35 p.m. — "A PROGRAM OF INSTRUCTION FOR MEDICAL-CLINICAL PHOTOGRAPHERS"

The mission and scope of a course of instruction to qualify skilled photographers in the application of photographic instruments and techniques in the medical arts and sciences, initiated and conducted by the Medical Illustration Service of the Armed Forces Institute of Pathology.

FLOYD C. EGGER, Medical Illustration Services, Armed Forces Institute of Pathology, Washington, District of Columbia

6:30 p.m. — COCKTAIL PARTY — EASTMAN KODAK COMPANY, *Host*

7:30 p.m. — ANNUAL AWARDS DINNER

Address: "LOCALIZED INFRARED BAND"

LEO C. MASSOPUST, F.B.P.A., Marquette University, School of Medicine, Milwaukee, Wisconsin

FRIDAY, 14 SEPTEMBER:

8:30 a.m. — SALON INSPECTION — Commercial Exhibits

9:30 a.m. — TWO CAMERA DEMONSTRATIONS, conducted simultaneously.

Each demonstration is one hour long and is repeated once to give everyone an opportunity to attend both.

"CINE PHOTOGRAPHY DEMONSTRATION"
MERVIN LA RUE, Mervin La Rue, Incorporated, Chicago, Illinois

"STILL PHOTOGRAPHY DEMONSTRATION"
FERDINAND R. HARDING, F.B.P.A., The Children's Medical Center, Boston, Massachusetts

11:30 a.m. — BUSINESS MEETING AND ELECTION OF OFFICERS

12:30 p.m. — SALON INSPECTION — Commercial Exhibits

2:00 p.m. — "PHOTOMICROGRAPHY DEMONSTRATION"

JOHN V. BUTTERFIELD, Bausch and Lomb Optical Company, Rochester, New York

7:00 p.m. — MOTION PICTURES

Films previously shown during the meeting will be repeated if requested by a group of ten or more persons

COMMITTEE

General Chairman
FERDINAND R. HARDING, F.B.P.A.

Program Chairman
C. GRAHAM EDDY, F.B.P.A.

Commercial Exhibits
LAWRENCE B. BROWN

Salon
National: H. LOU GIBSON, F.B.P.A.
Local: CLEON BABCOCK

Printing
MARK J. MCCANN, JR.

Publicity
PAUL SHOWSTACK

Projection
RALPH GLAZIER

Official Photographer
PIERRE LEDOUX

COMMERCIAL EXHIBITORS

American Optical Company, American Speedlight Corporation, Bausch & Lomb Optical Company, C. A. Brinkman & Company, Coreco Research Corporation, Dormitzer Manufacturing Company, Eastman Kodak Company, Heitz & Lightburn, E. Leitz Incorporated, J. A. Maurer Incorporated, Opplem Company, and the Wilmot Castle Company.

Salon Awards:

A large number of entries was submitted for the Members' and Open Salons, including black-and-white and color prints, color transparencies and several special exhibits. The salon was conducted under the chairmanship of H. Lou Gibson, FBPA. The following awards were given:

Monochrome Prints

Specimens:

First	STANLEY J. MCCOMB, Mayo Clinic, *(Chronic Arachnoiditis)*
Honorable Mention	STANLEY J. MCCOMB, *(Chronic Glomerulonophritis)*
	ROBERT E. DAVID, V.A. Hospital, Ft. Howard, Md., *(Cirrhosis of Liver)*

Photomicrographs:

First	PAUL H. RALPH, University of Washington, *(Living Testicular Cells)*
Honorable Mention	PAUL H. RALPH, *(Living Testicular Cells)*
	ROMAN VISHNIAC, New York, N.Y., *(Dileptus Anser)*

Natural History:

First	ZANE PRICE, Temple City, Calif., *(Radar)*
Second	DON J. MCDILL, Ward's Nat'l Science Est. Inc., *(Peripitus)*
Honorable Mention	F. W. SCHMIDT, University of Texas, *(Texas Denizen)*
	BERNARD H. MOLLBERG, U.S. Naval Research & Evaluation Laboratory, *(Skin Moult, Boa Constrictor)*
	BERNARD MOLLBERG, *(72 hour aluminum plated chick embryo)*

Clinical:

First	JOSEPH MERVA, V.A. Hospital, Cleveland, Ohio, *(3rd Degree Burns)*
Second	MR. FENDER, Manchester Royal Infirmary, England, *(Telangiectasia of the Cerebral Vortex and Dura, at operation)*
Honorable Mention	VERLIN Y. YAMAMOTO, V.A. Hospital, Des Moines, Iowa, *(Hand, Sebaceous cyst)*
	MARIA IKENBERG, University of Illinois, *(Papillomate of the Lip)*

Color Prints

Photomicrographs:

First	JOHN J. KATH, Merck Inst. of Therapeutic Research, *(Cortone Crystals under Polarized Light)*
Honorable Mention	ALEX A. GRAVESEN, Kennedy V.A. Hospital, Memphis, Tenn., *(Blastomycosis)*
	JOHN KATH, Merck Inst. of Therapeutic Research, *(Vitamin B12 Crystals)*

Clinical:

First	STANLEY D. HARRIS, Rockford Memorial Hospital, Rockford, Ill., *(Door Handle in Brain), (series of four prints)*

Honorable Mention — H. LOU GIBSON, Eastman Kodak Co., Rochester, N.Y., *(Melanoma)*

Specimens:

First — STANLEY D. HARRIS, *(Colon — Pedunculated Polyp)*

Honorable Mention — DEPT. OF MEDICAL PHOTOGRAPHY, Pathology Labs., ROCHESTER GENERAL HOSPITAL, Rochester, N.Y., *(Glanders Disease — Liver)*

Color Transparencies

Photomicrographs:

First — ROMAN VISHNIAC, New York, N.Y., *(New Method of Chromatic Polarization)*

Honorable Mention — WILLIAM J. CAMERON, V. A. Hospital, Batavia, N.Y. *(Photomicrographs)*

Natural History:

First — W. D. ROTH, Swift & Co., Chicago, Ill., *(Turkey Embryos)*

Honorable Mention — ROMAN VISHNIAC, *(Insects in Nature)*

Clinical:

First (Tie) — HOWARD T. TOENNIGES, V.A. Hospital, Des Moines, Iowa, *(Clinical Photographs and Gross Specimens)*

WILLIAM R. HOMMEL, V.A. Hospital, Des Moines, Iowa, *(Gross Specimens)*

Honorable Mention — JEROME SCHLEIFER, Adrian Brothers, V.A. Hospital, Dearborn, Michigan, *(Oral Pathological Lesions)* (panel of 12), *(Neuropathological Specimens)* (panel of 12)

ROCHESTER GENERAL HOSPITAL, Rochester, N.Y.
(14 x 17 mount — 20 3¼ x 4¼ Kodachrome Transp.)
(14 x 17 mount — 14 3¼ x 4¼ Kodachrome Transp.)

EARLE C. BARTLETT, Wayne University, Detroit, Mich. *(Gross Specimens)*

Slides 3¼ x 4

Photomicrographs:

First — MARGARET SCHELL, Chicago, Illinois, *(Lung Tissue 450 x (low power oil) showing cellular detail (cancer of lung))*

Honorable Mention — MARGARET MARKHAM, New York, N.Y., *(The Pathological Eye — Malignant Melanoma of Ciliary Body* (photographed directly from pathological eye section))

Specimens:

First — BERNARD F. SALB, Washington, D.C., *(Polycystic Kidney on blue background)*

Honorable Mention — LESLIE E. HIER, Minneapolis Minnesota, *(Overall — Polycystic Spleen), (Closeup — Polycystic Spleen)*

Slides 2 x 2

First	LUCIEN ST. LAURENT, Ottawa, Ont., Canada, *(Mountain Ash Sawfly Larvae)*
Honorable Mention	ED. BRITTEN, University of Hawaii, Honolulu, Hawaii, *(Bomeliads)*

Prints from Veterans Administration Headquarters

First	BRUNO MICKELEIT, V.A. Hospital, West Roxbury, *(Multiple Polyposis of Colon)*
Second	VERLIN Y. YAMAMOTO, V.A. Hospital, Des Moines, Iowa, *(Scalp, Fibrosarcoma)*
Honorable Mention	TIMOTHY DODGE, V.A. Hospital, Long Beach, Calif., *(Nocardia Asteroides)*
	E. O. ANDERSON, V.A. Hospital, Ft. Logan, Colo., *(Rheumatic Heart)*

Transparencies

First	RONALD M. CHRISTOPHER, V.A. Hospital, Temple, Tex., *(Bacterial Endrocarditis of the Heart)*
Honorable Mention	V. A. HOSPITAL, Hines, Ill. *(Hemangioendothelioma — Lung — x 405)*

Award certificates were presented to the Veterans Administration and the Navy Department for their excellently prepared exhibits.

Motion Picture Awards:

There were 15 films shown during the meeting. Of these 13 were on medical subjects and 2 were commercial films. Only the medical films were included in the judging.

The judging committee was headed by HARRIS B. TUTTLE, FBPA, who was assisted by ROBERT KOLVOORD and STEPHEN DITTMAN. The new method of judging that was published previously in the Journal (1951, 19:37) was used for the first time. It was interesting to note that the percentage points assigned by the judges for any given picture were quite close together.

The awards made by the committee were as follows:

Schizophrenia, Laryngectomy, Seizure and Asphasia, VETERANS ADMINISTRATION.

Macro and Microcinematography, MERVIN LARUE.
Cinefluorography, SIDNEY WEINBERG.

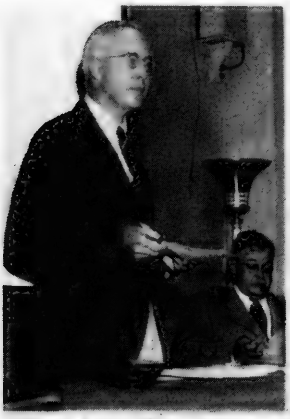
Special awards to commercial producers of medical films were:

The Bone Bank and *Migraine*, WARREN STURGIS, Sturgis-Grant Productions, Inc., New York, New York.

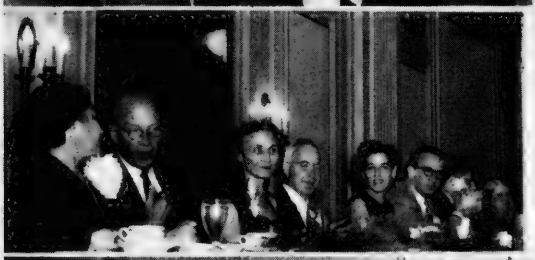
Kidney Function in Health and *Kidney Function in Disease,* MERVIN LARUE, MERVIN LARUE, Incorporated, Chicago, Illinois.

Honors Award Banquet:

As in previous years, the EASTMAN KODAK COMPANY sponsored a Cocktail Party for members and guests prior to the Annual Banquet. A very congenial atmosphere developed rapidly and the most timid souls soon made themselves known.



Boston Meeting 1951
as shot by
Pierre Le Doux.



An unusually fine banquet was served by the Hotel Kenmore, whose chefs we are glad to commend officially.

The following awards were made:

The Fellowship to:

LAURENCE B. BROWN, Harvard School of Dental Medicine, 188 Longwood Avenue, Boston, Massachusetts.

MISS AVIS GREGERSEN, Department of Dermatology, University of Southern California, School of Medicine, Los Angeles, California.

MERVIN W. LARUE, Mervin W. LaRue, Incorporated, Chicago, Illinois.

HENRY M. LESTER, Morgan & Lester Publishers, New York, New York.

SIDNEY SHAPIRO, Medical Illustration Lab, Veterans' Administration Hospital, Bronx, New York.

WILLIAM STEVENSON, Mt. Sinai Hospital, Cleveland, Ohio.

The prize for the best paper presented at the 21st Annual Meeting went to VERLIN Y. YAMAMOTO, Medical Illustration Laboratory, Veterans Administration Center, Des Moines, Iowa for his paper *"Greater Utilization of Teaching Aid Transparencies"*. The judging committee consisted of John J. Beiter, FBPA, Stanley J. McComb, FBPA, and John A. Vaughan.

As usual, the main event of the evening was the presentation of the *Annual Award* consisting of a newly designed certificate and a jeweled gold key. The award was presented by Stella Zimmer, FBPA, to RALPH P. CREER, FBPA, one of the founders of the Association.

The main address of the evening was made by LEO C. MASSOPUST, FBPA School of Medicine, Marquette University, Milwaukee, entitled *Localized Infrared Band.* Mr. Massopust held the entire group spellbound in disclosing the latest work indicating the importance of a narrow band of infrared radiation to the growth of living bodies, both plant and animal.

FIRST BUSINESS MEETING: September 12, 1951.

President's Address

Your Association is making steady progress. We have a small gain in membership that is slightly greater than last year's. This year it was necessary for Mr. Flory to resign as editor of our Journal and Miss Zimmer has resigned as treasurer. To both we owe gratitude for tasks well done. Stella has been treasurer as long as I can remember and I can easily sympathize with her desire to be relieved at this time.

I asked seven members to accept the editorship, but none were able to do so. To keep the Journal going in the emergency I took over the duties and have published three numbers this year. This position was too much for any one person to do in his spare time without remuneration. He had to do the editorial work proper, attend to the subscriptions from libraries and other nonmembers

and be custodian for back issues. Miss Zimmer generously took over the subscriptions for the emergency. Dr. Farris has arranged that the back issues can be stored at the Wistar Institute and they will mail them as required at no cost to the Association beyond postage and mailing envelops. We need a new editor, preferably one who is actually a biological or medical photographer, and ask all of you to help find one. I will continue as editor for 1952, but cannot promise you further help.

Our financial status is still critical. The year before last we had a considerable deficit and had to use much of our reserve funds. This past year we have stayed out of the red, but the gain is not enough to offset the previous loss. To do this we have avoided new projects and kept to an austere economy. For the Association to grow and the Journal to improve more income is necessary. Our Finance Committee, headed by Dr. Farris, has some concrete plans which I am sure will meet your approval and hearty support.

This year the problems of the salon and motion picture exhibitions have been codified and proposals of the chairmen have been published in our Journal with a request for your opinions and constructive criticism. So far no member has replied. Does this mean that you wish these procedures to be followed next year? The former Motion Picture Committee was dissolved by the Board and a new one appointed to succeed it with Mr. Eddy as Chairman. This enlarged committee has a broader scope and should bring much to our Association.

Your officers would like to hear from you, especially from the members who were unable to attend the Boston Meeting. Not having a crystal ball it is difficult and sometimes impossible to follow your wishes for our Association. What should we do for a better BPA?

Certification seems to be the major interest of many of our members. The Northern Ohio Chapter has had several good meetings on this subject and the national Association has an active committee studying it under the Chairmanship of Graham Eddy. Other societies are working on this subject in their fields. The American Society of Professional Biologists has a Certification Board to sponsor other boards by the biological disciplines involved. The American Board of Clinical Chemists, Inc., requires that the candidate satisfy them as follows: 1) on ethical and moral standards, 2) educational background as M.D. of Ph.D., 3) acceptable courses in analytical, biological and physical chemistry, 4) three years full time experience or 5 years in an educational institution, 5) written and/or oral examinations, 6) with ten years in a responsible position the degree requirements may be waived, and 7) to July 1st, 1952 they may certify without the examination. These rather strict requirements are backed by the American Chemical Society, the American Institute of Chemists and the American Society of Biological Chemists.

The Society of American Bacteriologists is proposing to found an American Institute of Microbiology which will be concerned with the improvement and safeguarding of practice, standards, qualifications of persons, and a specialty board to examine applicants. Two problems always appear, what standards are required and who is to be responsible for and to administer them. This sometimes leads to conflicts in groups. The Psychologists in setting up their board requirements had a dispute with the optometrists until they allocated certain problems in reading training practices. The Chemists and the medical men are in dispute in certain positions. The Pathologists have taken over the laboratory technicians. Any Society entering the certification field may expect similar problems.

Before we can discuss certification in our field, I believe we must have answers to the following questions: How many biological and medical photographers are there in the U.S.? How well trained are they? How many are needed? What should they know? Is it enough to make acceptable pictures, or should they know about sensitometry, chemistry, etc.? How should they be trained — in college courses or as apprentices? Will one high grade level be enough, or must we have grades of proficiency? Should a medical photographer know enough to do all biological photography, and vice versa, or should there be two certificates? Are we ready and able to do all this ourselves? Will larger groups like the American Medical Association accept our say, or, will they wish to try and steer our course. When we know all the problems we can embark on a safe course. Please help our committee by sending any material you can to Mr. Eddy.

We are now 21 years old. The time is at hand to really start working to expand the professional status that has come from our labors. May our eight hundred members accomplish proportionally more than did the few who started our Association some years before the birth of Kodachrome! My best wishes to all of you for a successful year and thanks for all the help you have given me.

OSCAR W. RICHARDS

Report of the Vice President: Mr. Eddy had discharged his duties by arranging the program for the Boston Annual Meeting. He asked that the program itself be accepted as his activities report.

Report of the Secretary: Mr. Varden advised members present that the Association continued to show a small but steady growth, having increased its number from 728 in 1950 to 782. The loss of four members due to deaths were announced as follows: Dr. John Fallon, Mr. R. C. Meigs, Mr. M. C. Schneckenburger and Dr. F. C. Wood.

Report of the Treasurer: Miss Zimmer presented a summary of her complete report as follows:

Receipts (Sept. 1, 1950 to Aug. 31, 1951)	$8,726.06
Disbursements for same period	$8,207.92
Surplus	$ 518.14
Bank balance as of Aug. 31, 1951	$4,950.79

Dr. Richards appointed the following committee to audit the Treasurer's report and requested that they report their findings at the Second Business Meeting: Albert Levin, FBPA, and Stanley J. McComb, FBPA.

Report of the Editor: Dr. Richards was able to report a more healthy financial situation with respect to Journal costs since his assuming the Editorship in May 1951. Three issues have been published.

Cost of printing and mailing February and May issues	$2,090.34
Freight on extra copies	8.51
Cost of Editorial Office to September 8 (Postage, supplies and back numbers bought)	43.42
Income from sales of back issues (incl. accounts receivable)	24.50

Nearly enough manuscripts are in hand for the February issue. All members were urged to submit criticisms, suggestions for articles and manuscripts to the Editor so that the Journal will best serve the needs of our members.

Reports of Committee Chairmen:

Motion Picture Committee: In accordance with instructions formulated at the May 19, 1951 Board Meeting, the President dissolved the Motion Picture Committee and in its place appointed a larger Motion Picture Committee with broader functions. Members appointed to the new Committee are:

Mr. C. Graham Eddy, *Chairman*

Dr. Ralph Buchsbaum	Mr. Warren Sturgis
Dr. Harry E. Morton	Mr. Harris B. Tuttle

This Committee is to submit, for the approval of the Board, recommendations for:

1. Defining the scope and purpose of the Committee.
2. A plan of action for the coming year.
3. Policies and procedures governing exhibition and judgment of motion pictures.
4. Establishment of criteria for making awards and types of awards to be made.

5. Scope and purpose of the Motion Picture Report.
6. Criteria for selection of films to be included in the Motion Picture Report.
7. Any other concepts considered by the Committee to be pertinent to its functions.

Information received from Association Members concerning their film activities has been excessively scanty. One non-commercial film maker reported two films produced in 1951, and one commercial producer reported 18 films produced from 1948 through 1950, and 14 films in production in 1951. In terms of the Association's aggregate film activities, those noted above are an insignificant fraction. It is felt that with a clear statement of purpose and criteria for selection of films to be reported, a more coherent picture of the Association's film activities may be drawn from its members.

From various sources there were six film meetings reported, four of them foreign and two in the United States. Finally, one British book and one American pamphlet were reported.

This sorry showing of information submitted by Association Members is not suitable for publication. By individual effort on the part of members of the new Motion Picture Committee, it may be possible to provide a significant body of film information useful to Association Members.

Fellowship Committee: Mr. Harding announced that the newly elected Fellows would be disclosed at the Annual Banquet. He then reviewed the procedure for Fellowship application.

Award Committee: The candidate elected was not announced but members were advised that the announcement would be made at the Annual Banquet.

Chapters Committee: Warren Sturgis reviewed the present chapter structure. He announced that the Board had granted the newly formed Philadelphia Chapter a charter and that other chapters were being organized in Rochester, Minn., Nashville, Tenn., and Pittsburgh, Pa. He announced that the Board had approved dropping the word "local" in connection with chapters. A meeting of chapter representatives was called for Thursday morning.

Exhibition Committee: Bill Taylor was not present but he had submitted the following report in writing. (slightly condensed version)

Efforts to obtain exhibition space at the 1951 A.M.A. Convention was unsuccessful. There is every reason to believe that we shall be able to exhibit at the 1952 A.M.A. Convention in Chicago. It is suggested that John Withee's exhibit prepared for the Hitchcock Foundation be used in connection with other B.P.A. Salon prints for the A.M.A. It has been arranged to show Mr. Withee's exhibit at

the Boston meetings so that the Board can determine its applicability. The Secretary was requested to ask Mr. Taylor to get in touch with the Chicago Chapter about the 1952 A.M.A. meetings.

Traveling Salon: The following report was submitted by Mr. Thomas J. Lannon in writing:

"There were only two requests for the exhibit during the year: 1.) University Camera Club of Purdue University. The attendance for this meeting was 63. After the meeting it was displayed in the Biology Department for the faculty and students. All in all, several hundred viewed the exhibit with a great deal of interest and enthusiasm. 2.) The annual meeting of the American Osteopathic Association at Milwaukee, Wisconsin. A letter from the Chairman of Scientific Exhibits thanked the Biological Photographic Association for the excellent exhibit.

"It is requested that more publicity be given to the Traveling Salon in the Journal."

Concerning the Journal publicity, Dr. Richards agreed to do so as soon as he was supplied with full details.

Nominating Committee: In the absence of the Committee Chairman, Miss Avis Gregersen, Chester Reather read the report as follows:

President	C. Graham Eddy
Vice President	Warren Sturgis
Secretary	Lloyd E. Varden
Treasurer	Albert E. Levin
Directors (to serve 3 years)	John Beiter
	George L. Royer
	Stella Zimmer
Director (to complete Albert Levin's term)	David Lubin

No additional nominations were made by the Board or by members-at-large.

Certification Committee: Mr. Eddy stated that President Richards had reviewed the general situation in his annual report. He was glad to add that he was now collecting material from many other groups for study.

Mr. Dave Lubin called attention to the fact that no motion from the floor had been made to put certification into the BPA program officially.

Financial Committee: Dr. Farris emphasized that the Association must be self-supporting. It must provide funds for progressive moves and activities. He proposed the following fund raising idea: a.) Appeal to members at the annual meeting to become contributing members. b.) Mailing of a special letter to members for contributions. c.) Establish a membership drive committee.

Other fund raising ideas had been explored. Manufacturers were considered not a good source of continuous income. Approaching foundations not too good unless definite projects are proposed. Dr. Farris recommended Harris B. Tuttle as the Chairman of a new membership drive committee with a request that the Board approve $400.00 for the committee's expenses. The Financial Committee would continue to function, working with the membership drive chairman. The Financial Committee, however, would suggest how the additional income, if obtained, should be used to the greatest benefit of the Association.

Mr. Harris B. Tuttle was asked to accept the chairmanship of a new membership drive committee. He accepted pending Board approval of funds to carry on the work. (Funds were later approved by the Board.)

Constitution Revision: Mr. Eddy moved that Article VIII be suspended for 60 days to give the Secretary an opportunity to introduce minor changes in the Constitution and By-Laws. There were no negative votes, and so the motion was passed. The Secretary announced that the revised Constitution and By-Laws will be published in a future issue of the Journal.

1952 Meeting: Warren Sturgis announced that the 1952 annual meeting of the Association would be held at the Hotel New Yorker, New York City, September 10-13, 1952.

Selection of City for 1953 Meetings: Dr. Richards announced that three invitations so far had been received for the BPA meetings in 1953, namely, Houston, Texas, Montreal, Canada and Los Angeles, California. He requested that these cities be considered for further discussion and official voting at the Second Business Meeting.

SECOND BUSINESS MEETING: September 14, 1951

Election of Officers and Directors: The Nominating Committee report was read by the Secretary. Ferd Harding moved and Percy Brooks seconded that the Secretary cast a ballot for the entire membership. Motion carried.

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Auditing Committee Report: The President had appointed Al Levin and Stan McComb to audit the Treasurer's books. This had been done and Mr. Levin reported the books in good order.

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Although no one was present from the *West Virginia Chapter,* Mr. Al Levin advised that the chapter had been active.

Mr. Charles Foster reported that the *Rochester, New York Chapter* held its organization meeting on April 2nd with 28 people attending. It now has 21 members signed up and big plans are being made for the coming year.

Selection of City for 1953:

Following a lively discussion, Los Angeles was selected for the Association meetings in 1953.

It was agreed that the Annual Meeting in the future should be held in the first part of the week and that the 1953 meeting should convene sometime during the last ten days in August.

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COMMITTEE CHAIRMEN

AWARD: RALPH CREER
535 N. Dearborn Street
Chicago 10, Ill.

CHAPTERS: WARREN STURGIS
314 East 46th Street
New York 17, N.Y.

EXHIBITIONS: WILLIAM J. TAYLOR
1429 East Johnson Street
Philadelphia 38, Pa.

FELLOWSHIP: GEORGE L. ROYER
Calco Chemical Div.
American Cyanamid Co.
Bound Brook, N. J.

FINANCE: EDMOND J. FARRIS
Wistar Institute
Philadelphia 4, Pa.

MOTION PICTURE: C. GRAHAM EDDY
Medical Illustration Division
Veterans Administration
Washington 25, D.C.

MEMBERSHIP: ANNE SHIRAS
Photographic Department
Magee Hospital
Pittsburgh 13, Pa.

MEMBERSHIP DRIVE: HARRIS TUTTLE
343 State Street
Rochester 4, N.Y.

PUBLICITY: LLOYD E. VARDEN
533 West 57th Street
New York 19, N.Y.

SALON: H. LOU GIBSON
343 State Street
Rochester 4, N.Y.

TRAVELING SALON: THOMAS LANNON
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Send change of address to the Secretary, Mr. Lloyd Varden, c/o Pavelle Color, Inc., 533 W. 57th Street, New York 19, N. Y., at least six weeks before the next issue.

OFFICIAL PUBLICATION OF THE BIOLOGICAL PHOTOGRAPHIC ASSOCIATION, INC.

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Klio and Vario shutters. The new improved model features a longer bracket and a rotating battery case, enabling the photographer to position his reflector above, beneath, or on either side of his camera. List price: $7.20 with battery, Federal tax included.

Penn Camera, 126 West 32nd Street, New York City, announces the import and availability of a new German 35mm camera, the REGULA II, figure 3, listed at $49.50, Penn has arranged for special terms and will sell this camera for $32.50, including Federal Excise Tax, with a one-year guarantee. It has a coated ENNAGON f:3.5 5/50 lens, built-in flash synchronization, a synchronized Prontor-S shutter and shutter speeds from 1 to 1/300th second and Bulb. It incorporates a brilliant eye-level optical viewfinder with large viewing area, a built-in self-timer for delayed action shots, a double exposure prevention devise and a body release with thread for cable release. The camera has a built-in indicator — white for unexposed film, red after exposure is made and is an all metal camera with no-bellows using standard 35mm black-and-white or color films.

A Leather Eveready Carrying Case costs $5.50 and a Heiland Synchro Mite flash unit for this camera, $9.95, including tax.

The Bolsey Corporation, 118 East 25th St., N.Y.C. 10, announce a new medical-scientific research camera, figure 4, which incorporates in one portable, compact, and light unit, a Bolsey B Special 35mm close-up camera, a specially designed built-in strobo light and a system of "range frames", making its operation extremely easy and simple.

The strobo light source is a newly developed small ring-shaped tube of 1½" diameters concentric with the camera lens and closely surrounding it, giving a shadowless shaftlike illumination which penetrates the cavities of the human body, surgical incisions, and mechanical devices. Its daylight quality light permits the use of daylight color film. A set of frames covering various areas ranging from approx. 1½" x 2" to 5¼" x 8" and larger are used as complete guides in setting the camera and shooting. A series of pre-focused distances for various subject areas are marked on a mono-rail which acts as a frame support, and which holds these frames rigidly in front of the camera. The operator chooses the frame which will cover the desired area to be photographed. He reads the instructions which are printed on this frame and which tells him to set the camera.

The camera and strobo unit are completely explosion-proof — important in the surgical operating room and in other test areas where inflammable gases or liquids are present. Its strong light output, combined with the semi-wide angle of the lens of the Bolsey camera (1¾", 44mm focal length) which allows the use of very small diaphragm openings, provides the photographer with remark-

able depth of field. For example, at f:22, shooting in color or black-and-white at 6½ inches, the picture is sharp from lips down to larynx.

The camera, which features an f:3.2 44mm hard-coated, color-corrected lens with coupled rangefinder, speeds of 1/10th, 1/25th, 1/100th, 1/200th second, time and bulb, and with provisions for interchanging of lens, if desired, can be used also as an excellent all-purpose camera without sacrificing any of its features. Without the strobo light, it can be used as a portable daylight camera, or with Bolsey flashgun it can be used for night flash photography.

The complete unit, which will list for approximately $250.00, will include a Bolsey Model B Special Camera, a set of 3 extension rings, strobo-light unit to be used on 110-115 volts (special unit for use with portable battery) power pack, extension cords, set of frames, 2 extension bars, hand grip with trigger cable release . . . all in beautiful light color cow-hide leather case.

The growing demand for a practical container for shipping or mailing 2 x 2 glass slides has prompted Barnett & Jaffe, 637 Arch Street, Philadelphia 6, Pa., manufacturers of BAJA cases for slides, slide files, projectors, cameras and reels, to announce two new models: PP-48 to hold up to 48 glass slides, figure 5, and PP-100 to hold up to 100. List prices $5.25 and $6.25.

The container is made of hard vulcanized fibre board ruggedly assembled to withstand the hazards of shipping. Two address cardholders are riveted to the outside and address cards are supplied with the case. A strong web strap is provided for securing the container. The slides are held in a one-piece molded plastic unit cemented into a soft resilient felt cushion to prevent breakage of slides in transit.

New products shown this year at the Milwaukee meeting of the Photographers' Association of America included:

1. EASTMAN KODAK COMPANY. a. Kodak *Medalist Paper,* a high speed paper designed for commercial and pictorial printing. It will be available in four conrast grades, and supplied in three popular surfaces, the normal F and G surfaces and a new surface called J. This is a white fine grain high lustre surface, ideal for airbrushing and other surface work. This paper will be available in October. b. Kodak *Ektalure Paper G* — a new warmer toned paper for portraiture. It is twice the speed of Opal G.

2. GRAFLEX, INC. a. The Graflex *identification unit* with portable, easily dis-assembled stand, b. The Graphic *View II Camera* with *Ektalite Field lens,* c. An accessory wide-angle view finder for Graphic cameras, and the d. Graphic all-metal *tripod.*

3. REVERE CAMERA COMPANY, Chicago Ill. a. New long-play *tape recorder,* featuring a two hour play on a five-inch reel of tape. List price will be $179.50, b. Revere also demonstrated their *Diaversal process* of making monochrome prints from any size color transparencies or slides for the studio and photo finishing plant trades.

4. STROBO RESEARCH, Milwaukee, Wis., showed their new *SR Monostrob,* a first 3-in-1 Flash unit adaptable for news and magazine, as well as studio work.

5. PROJECTOGRAPH CORP., Oshkosh, Wis., showed a new automatic, continuous projector in which 2 x 2 slides are placed in a *"Pic-Disk",* a feature which permits instantaneous switching from one set of pictures to another. Clear-screened, the unit has a stop switch. Projection time for each slide is 15 seconds, can be adjusted to 5 and 10 second intervals, also.

A Note From Australia

HARRIS B. TUTTLE, F.B.P.A.*

In the autumn of 1949 I had the pleasure of meeting Mr. Reginald Johnson of Sydney, Australia. At that time Reg spent several weeks in Rochester, New York, and met many B.P.A. members in New York, Chicago, and Los Angeles as well as in Rochester. A report of his visit was published in the February, 1950 issue of the Journal on page 46.

Reg has written me frequently since he returned to Australia and kept many of us informed on his work. Soon after returning home he gave up his private business and is now devoting all of his time to medical photography and to research in the medical field at the Royal Prince Alfred Hospital in Sydney.

Following are a few paragraphs from a recent letter which will be of interest to many of our B.P.A. members. "Our interests of late have been multitudinous, and they range from Polio research (which is a 'number one' worry out here in Australia at present) right through medical film work, to special cinemicrography in relation to Spermatozoa and Sterility, and then on to photomicrography of swabs taken from the country's leading race horses! The race horse is a section of my work that requires special photomicrography, and as racing is really big out here, they are going in for dope research in a big way to protect the names of our Interstate Jockey Clubs, who of course are big financial concerns. We have

* Eastman Kodak Co., Rochester, N.Y. Received for publication August 12, 1951.

been working with the chemists of the Sydney Laboratory of the Jockey Club, and they have given us plenty of worry as regards the right method of making microscopic pictures of dope crystals taken from the urine and saliva of winning horses, (and losing favorites also!). After much research in this direction, we have now settled in favor of phase microscopy in combination with polarized light work, which is giving good results. All shots are taken of crystals in a highly fluid state, and as we cannot evaporate the specimens due to reagent reaction, it has been very difficult getting down to a working basis that will stand up in a court of inquiry.

"We now have a branch of the Scientific Film Society out here, and it was introduced by a Dr. Anthony Michaelis who has come out from England to settle here. He is at present working in the Sydney University in the honorary capacity, and has quite a lot of equipment, including a Kodak High-Speed Camera.

"Since last writing, we have been getting very good results on our surgical filming, and my surgeon friend, Dr. McMahon, is more keen than ever on making really good teaching pictures of lung and heart surgery. At present I work right over his shoulder and use 50mm and 63mm Ektars on lesions, and bronchus sutures, etc., and they fill the entire picture field and look terrific in color on the screen.

"I have spent many long days on micro-research, and this new Reichert Micro Camera has done some good work for the medical men here, and in other hospitals and places of industry also. I recently imported a Wild Research Microscope which was made by Wild in Switzerland, and as this concern is world-famous for many instruments, including an L8,000 aero camera, they turned out a really magnificent job in their first microscope. It is not any better optically than my Reichert or Leitz research models, but is way out ahead as regards mechanical perfection.

"The new Cine Ektars are really grand, and they give detail and brilliance that is surprising. I expect to be making some special spectrum pictures soon with them, and will certainly feel no worry as to the quality of picture they will give me. We are also doing a film on sterility, and are using special stains on the spermatozoa with excellent results on the still color pictures, but as yet not so good on the motile sperms, due to the fact that we cannot adequately stain living sperms.

"We are also getting around to the idea of buying an electron microscope and hope to when I get back from my trip to England, and while I have already found some very fine books on this technique, I realize that one would have to work very closely with a physicist to understand all that it implies."

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Suggestions for Contributors

Manuscripts should be sent to The Editor, Journal of the Biological Photographic Association, 70 Alton Road, Stamford, Conn.

Manuscripts must be typewritten, double or triple spaced, with full margins. The original and not a carbon copy should be submitted.

References: References may be given as footnotes or, if numerous, may follow the context. They should be given in the following forms:

Book—Valasek, J. 1949. *Introduction to theoretical and experimental optics.* John Wiley & Sons, N. Y. x+454 pp.

Journal Article—Carman, P. D. 1949. Photogrammetric errors from Camera lens decentering. J. Opt. Soc. Am. 39(11):951-954.

Tables: Tables should be typed on separate pages and should have captions which will explain the data without reference to the text.

Illustrations: Wherever possible illustrations should conform to the following proportions:

Horizontal—the quotient of the height divided by the width should equal 0.7.

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Full page illustrations should not be less than 6.7 inches by 9.5 inches. Others should not be less than 4.25 inches by 6 inches.

When mounted, illustrations should be twice or three times the page width which is 29 picas, or 4-5/6 inches. Illustrations for the cover should be multiple of 39 picas, or 6.5 inches.

Legends should be typed on a separate sheet and keyed for identification.

Editorial Policy: The Editor will endeavor to cooperate with the author by following suggestions regarding layout where it is feasible. The cost of publication may make it necessary to revise the text and group illustrations. The author will be advised of any extensive changes.

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